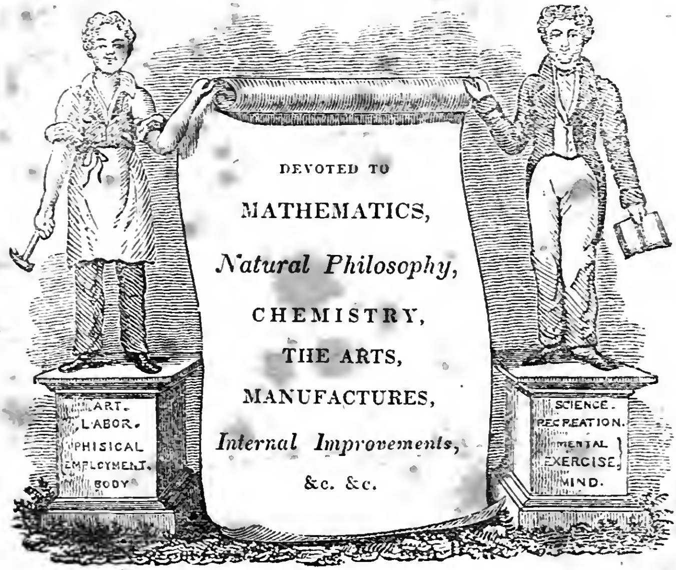
THE

# YOUNG MECHANIC.

CONDUCTED BY

AN ASSOCIATION OF PRACTICAL MECHANICS.




If those who are occupied in the proper business concerns of life, and its severest toils, had really no time for study, then would the great mass of society be doomed to perpetual mental degradation; but every man can spare at least one hour in the twenty-four to the improvement of his mind; and one hour a day is about equal to four entire years in every twenty; which, so far as time is concerned, is sufficient to complete as extensive and varied course of study as can be pursued, from entering to leaving college.—*Freedom of the Mind.*

## VOLUME I.

BOSTON:
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1832.

# PREFACE.

The Conductors of the Young Mechanic, although they have had to encounter many difficulties, have the satisfaction of seeing one year of their labors completed. Their plan was to some extent an experiment. Having observed—and with no small degree of regret—the ill success of several similar works in this vicinity, they thought it inexpedient to attempt the establishment of a very large, or in any respect a very expensive magazine. But they were fully persuaded, that, by adopting in this case the principle upon which all undertakings should be commenced—viz. to begin according to one's own means and the prospects before him—they might be able to effect the object which their predecessors in this part of New England had failed to accomplish. This principle was acted upon; and their expectations have been met. They looked particularly to the younger portion of our mechanics for their countenance and co-operation in the plan; and they have not been disappointed. They are glad to say, that, so far as they are acquainted, the work has been approved of, and, what is more to the point, well patronised, wherever it has been introduced. The editors of some of the best publications of the day have also shown a warm interest in its success.

Of the faults of the present volume the Conductors are deeply sensible. But they have gained experience, and their resources

are multiplied; and they believe that, knowing now better than before the wants of the class to whom their labors are devoted, they will hereafter be better able to supply them. *Their* motto, and they believe the motto of all who are engaged with them, is, 'IMPROVEMENT.' It will be one of their prominent objects to give the coming volume a more familiar, as well as instructive character. They ask indulgence for what has been amiss in the execution of their design thus far, trusting that, by the continuance of the support which has been received, they will be able, in the next volume, better to satisfy themselves, and answer the expectations of their subscribers.

Boston, December, 1832.

THE

# YOUNG MECHANIC.

VOL. I. JANUARY, 1832. No. I.

## TO YOUNG MECHANICS.

THE purposes proposed in the establishment of this Magazine are so well and so generally understood by most of those who are particularly interested in it, that it is not necessary to enlarge upon them. A brief summary, by way of recapitulation, and with the view of reminding our patrons—or pupils, as they may choose to be entitled—of what we hope to do for them and with them, is all that can now be expected of us.

The grand object is, to diffuse general elementary knowledge. There is no one of the arts practised among the subscribers to the YOUNG MECHANIC but is connected intimately with one or more of the sciences. 'All arts and sciences,' said a venerable philosopher of the ancient world, 'have a common bond of union.' Of two individuals engaged in the same department, be it what it may, the one who is most familiar with the *principles* of his business will always have an advantage over him who is expert only in the use of his tools. Farther than this, of two who are equally familiar with both the science and the art in question, he will have the advantage who has the most *general* information—the best disciplined mind—the firmest habits of mental industry, of vigilant observation of men and things, of persevering effort, of thorough inquiry, and of systematic and accurate reasoning. So much for mere success—emolument and reputation—in one's trade. We need not in this place undertake to show, that the character and influence of the well-informed man among and over his fellow citizens at large, will always be advanced in an equal proportion by those same efforts which go most immediately to promote his own interest. It need not be proved, that he will become just so far the better husband, father, citizen, the more fit for office

or honorable distinction of any kind, and the more likely to obtain them. Nor does any one require to be told, that the reputation of the whole body of mechanics, here and elsewhere—and with their reputation everything that depends upon it—must be founded upon the qualifications of the individuals who compose it.

As to the particulars of the plan upon which the Young Mechanic is to be conducted, we believe that they need not be set forth minutely at this time. Elementary information relating to any of the arts, will be gladly made use of whenever furnished in such quantities, and in such a style of plainness and clearness, as to be in our opinion calculated to benefit those for whom it is meant. Questions and queries will frequently occur at the Lyceum and other meetings, in conversation and in reading, which may be suggested and discussed in our columns to advantage. The Magazine may also be the medium of making known the new inventions which occur within the knowledge of our readers.

In fine, we put great confidence in the class of individuals for whose benefit our time and labor will be given, that they will work with us, and feel an interest in our success. And if *that* be the case, of success we cannot fail. The very effort to improve, always does improve. Labor is discipline and power. The inanimate magnet itself, is constituted by the laws of nature to have new strength added to it by every trial made upon what it already possesses.

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## NATURAL PHILOSOPHY.

We have taken Webster's Philosophy from which to make some extracts on this subject. This work appears the most appropriate for our purpose, it being very concise and containing sound matter. It was edited some years ago by Prof. Patterson, and more reeently by Amos Eaton of the Rensallear Schools. Chemical Affinity, Electric and Magnetic Attraction, have been omitted. These subjects will be treated on with the sciences to which they belong. Some of the more abstruse illustrations are also left out.

Natural philosophy is that science which considers the powers of nature, the properties of natural bodies, and their action on each other.

Illustration. Natural philosophy is distinguished from chemistry, by its treating on the laws of natural bodies in mass; whereas chemistry treats of the laws of the constituent atoms of bodies, as those atoms bear relation to each other.

### THREE LAWS OF MOTION.

1. Every body continues in a state of rest, or moves uniformly in a right line, unless it be compelled to change that state by the

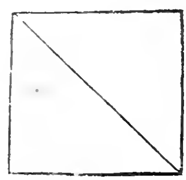
action of some external force. This law of matter is called *vis inertiae.*

Illustration. Thus a ball discharged from a cannon would persevere in its motion forever, if it were not retarded by the resistance of the atmosphere and the operation of gravity. Or a top put in motion would have an endless revolution, if it were not impeded by the air and the friction produced by its point on the plane on which it moves. According to this law, the heavenly bodies also preserve their progressive motions undiminished in those regions which are void of all resistance.

2. The change of motion is always proportional to the moving force by which it is produced, and it is made in the line of direction in which that force is impressed.

Illustration. By the first law, motion cannot be generated in a body, without some external impulse; and as the motion thus generated is directed in a right line with a velocity equal to the degree of impulse, the course of a body in motion can only be altered by a fresh impulse, and is then compounded of its own velocity and the impelling force; that is, the body will be either accelerated or retarded in a right-lined direction, in proportion to the compound force of the two impressions.

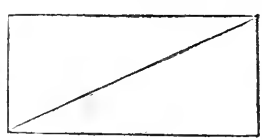
A B



C D

In the square A B C D, if a body be put in motion by an impelling force in the direction A B, and if at the same instant it be acted upon in an equal degree by another impulsion in the line A C, the body will be projected with a force and direction, compounded of the two impulses, which is represented by the diagonal line A D. In like manner if a ship at sea sail before the wind, in the line G H, due east, at the rate of eight miles an hour, and a current set from the north, in the direction G E, at the rate of four miles an hour; the vessel will be driven between the north and the east in the direction G F, compounded of the two acting forces, at the rate of nine miles an hour nearly.

E F



G H

3. Action and reaction are always equal and contrary. Or, the action of two bodies on each other is always equal, but in contrary directions.

Illustration. Thus, if a stone is pressed by the hand, the reaction or compressive force on the hand, is equal to the pressure upon the stone. Or, when a horse draws a load, the power of the horse is diminished, or the animal is drawn back, with a force equal to that which puts the load in motion: for, if the weight of of the load be increased till it is equal to the strength of the horse,

it will remain at rest, although the whole force of the animal be in action. If a loadstone, and a piece of iron of equal weight, be suspended by strings near each other, the mutual force of attraction between them, will cause an equal action, and the two bodies will leave their respective positions with an equal impulse and velocity, and meet in a point equally distant from each.

If the bodies be unequal, they will meet in a point whose distance from the bodies will be reciprocally proportional to the difference of the powers.

If two floating vessels of equal magnitude be attached by a rope at some distance from eath other, a force applied to the rope in either vessel, will mutually draw them together, with an equal velocity, till they meet in a point equidistant from their first position.

### ATTRACTION.

Attraction is the cause, power, or principle, by which all bodies mutually tend towards each other.

Illustration. This universal principle is considered as one of the first agents of nature in all her operations. By this extraordinary power, the minutest particles of matter cohere, bodies are formed, and even the whole universe is governed by its influence; yet, after endless opinions, its cause is still concealed in the bosom of nature. We clearly view the effects of attraction, and decide on its laws, but human ingenuity has not been able to fathom its principle or essence.

Newton considers it as a power or virtue proceeding from bodies in every direction, which decreases in energy or effect, in proportion as the squares of the distance from the body increase; that is, at any given distance, it will be four times as great as at twice that distance, and nine times as great as at thrice the distance; and so on in like proportion.

This law, however, only relates to one branch of attraction, as it has different modifications in its different divisions: these are called attraction of *cohesion*, *electrical* attraction, *magnetical* attraction, and attraction of *gravitation*.

### ATTRACTION OF COHESION.

Attraction of cohesion is that force by which the particles of bodies mutually tend towards each other.

Illustration. It is the most powerful in the point of contact, or where the particles touch; at a little distance, it becomes considerably less; and when the particles are still farther removed, the effect is rendered insensible.

The power of corpuscular attraction, or the cohesion of particles of small bodies, may be shown by a variety of amusing experiments.

Take two leaden bullets, with a part cut away from each of their surfaces, so as to form a small plane, perfectly smooth and even.

This being done, press the flat surfaces together, twisting the bullets with the fingers as they are pressed; then the parts which touch each will adhere or be attracted with such force, as to require a power of more than fifty pounds weight to separate them.

The twisting of the planes of the bullets serves only to bring the parts nearer together; for, as it is scarcely possible to cut the surfaces perfectly even, this twisting pressure tends, from the softness of the metal, to rub down the inequalities, to expel the air which is contained between the planes, and to bring a greater number of parts into contact.

As the formation of bodies arises from the adhesion or attraction of the particles of matter; if the metal in the above experiment were perfectly free from porosity, and the planes mathematically even, on joining them together, the parts in adhesion would be as firm and inseparable as any other parts of the bodies.

But as corpuscular attraction extends only to infinitely small distances, and as a considerable part of the surfaces cannot come into contact, not only from the porosity of the metal, but from the inequalities of the planes; the elasticity of the air, which is contained in the interstices, is perpetually endeavoring to force them asunder.

The planes can only adhere when the power of the parts in contact is greater than the natural gravity, and the elastic power of the air contained between them; therefore the cohesive force is proportionable to the number of parts that touch each other.

If oil, tallow, or any other unctuous body, be smeared on the surface of the planes, in such a manner as to exclude a principal portion of the air which is contained between them, the planes will adhere with much greater firmness; so that plates of brass, silver or iron, of small dimensions, may be made to cohere with such force, as would require the united power of a number of men to pull them asunder. Experiment has shown, that plates not more than two inches in diameter, have taken a force of 950 lbs. weight to separate them, when the surfaces have been heated and smeared with boiling grease, and then left to cool before the power was applied. This adhesive power or quality in the particles of bodies, is not occasioned or aided by the gravitating weight of the atmosphere; for it is found by experiment, that it requires the same weight to separate them whether they be joined together in the open air or in vacuo.

By the attraction of adhesion the particles of a liquid arrange themselves in a spherical form.

Illustration. Rain, in falling from the clouds through the atmosphere, is formed into small spheres by the mutual attraction of the particles of water. The drops of rain which rest upon cabbage leaves, and other vegetables that are covered with a fine powder, also assume a spherical appearance from the same principle. Globules of quicksilver are formed in like manner, by the attraction of their parts, and incorporate by the same principle

when different globules come into contact. If a piece of board, or any other plane be laid on the surface of water, it will require a power six times as great as the weight of the body to take it up perpendicularly.

These, and many other facts which daily occur in the common occupations of life, serve to show the universal tendency of that corpuscular attraction which exists between small bodies; whilst the attraction of gravitation, extending to indefinite distances, causes all the regular changes and successions in the planetary system. Thus the Divine Being, by a different modification of the same incomprehensible principle, compounds and preserves the whole system of his works.

By that variety of the atttaction of adhesion, called capillary attractions, liquids ascend between the contiguous surfaces of bodies.

Illustration. Take two plates of glass ground even, and place them edgewise, very near to each other, in a vessel of water, first wetting the insides of the plates; then the attracting power of the glass will raise the water which is contained between them considerably above the general surface of the fluid. This height is proportional to the distance of the plates from each other. If they be placed about the hundredth part of an inch asunder, the water will rise more than an inch above the common surface in the vessel.

Capillary attraction is generally used to denote the ascent of fluids through small pipes or tubes, that compose a considerable part of the animal as well as vegetable body. If these tubes, which are as various in their number as they are different in capacity, by the energy of the living principle, nature conveys nutriment to supply the most distant branches of vegetation, where it could never arrive by the ordinary motion of fluids.

These tubes, as well as glass tubes, attract in an inverse proportion to their diameters, as the glass plates attract in proportion to their contiguity; that is, those tubes which are the smallest, raise the fluid to the greatest height, and the larger to a less height in a reciprocal proportion.

When the earth receives rain on its surface, the fluid is attracted through all the internal and contiguous parts; it is then absorbed by the roots of trees, plants, &c. and afterwards carried by capillary attraction to the most extended ramifications, through the multitudinous pores contained in the trunk and its branches.

Melted tallow and oil supply the flame of candles and lamps by the capillary attraction of the threads of the wick. Water poured round the bottom of a heap of sand, sugar, ashes, or any other porous substance, will diffuse itself till it has reached the summit. On this principle, perpetual springs are often supported on hills. This attracting power is likewise observable in lump sugar, sponge, linen, and many other bodies, when their lower extremities are dipped into water. In short, every porous or capillary substance is a conductor for the attracted fluid. This attracting power acts

independently of atmospheric pressure; for if capillary tubes be placed in a vessel of water under an exhausted receiver, the fluid will ascend to the same height as when the experiment is made in the open air.

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## CHEMISTRY.

We have made an extract from Dr. Hanaford's Lectures on Chemistry. The author has been at considerable trouble to condense his subject into a small volume. We only regret the absence of plates, to illustrate the more complicated apparatus. We differ a little from the Doctor, as to technical language; for no person can be master of any subject, if he is ignorant of the scientific phrases commonly used.

The object of Chemistry, it has been said, is to ascertain the nature and properties of all material things, not only in their simple state, but also in their infinitely varied combinations. Its range is extremely wide; there is no science, probably, under the head of which, are arranged such a vast number of unconnected facts, as in this. Although this is the case, still the *elementary* constituents of these almost innumerable substances, are not very numerous, being estimated only at about sixty in number.

A simple substance or elementary principle, in this science, means such as has never been decomposed, or reproduced by artificial means—of such, as has been stated, there are about sixty.

Simply for the purpose of more easily obtaining a knowledge of these, and their different compounds, they are generally, either in a description of their properties in books, or a notice of their properties by experiments, divided into classes.

The utility of classification in this, is about the same that it is under any other circumstances; i. e. by throwing together a certain number of facts or principles, in the same class, by becoming acquainted with the definition of such class, we gain a certain knowledge of all the principles placed in it, with the same ease that we should any particular one, without this classification.

Very different arrangements are made by different writers. In the one which we shall adopt they are divided into four classes, and in this classification we have reference to their sensible qualities.

In the first class are what are generally called the Chemical Powers, viz. Affinity, Caloric, Electricity, and Light. They are so called, because all chemical changes are wrought upon other substances, by the application of some one of them.

Affinity, which is merely a property of matter, is placed in this class because its effects are somewhat similar to the others in the same class; i. e. it produces chemical changes.

In the second class are such substances as have the property of supporting the common process of combustion, and rendering other substances *sour*. Hence called acidifying substances and supporters of combustion. The names, Oxygen, Chlorine, Fluorine and Iodine.

Without the presence of some one of these, it is supposed, we cannot have the common process of combustion or fire; neither can we have any substance, the taste of which is sour, in the composition of which some one of these do not form a part.

In the third class are such substances as have the property of undergoing combustion, and being rendered sour—changed into acids, by being united with some of the substances in ths last mentioned class—hence called acidifying and combustible substances, not metallic.

The names—Hydrogen, Nitrogen, Sulphur, Phosphorus, Carbon and Boron.

In the fourth class are the metallic substances, very numerous, in properties much unconnected with any of the substances in the three first classes, and as it requires much time to illustrate many of their properties, by experiment, and as a knowledge of them is of not so much use or interest to the generality of persons, but *little* notice will be taken of them in this short sketch.

## AFFINITY.

Affinity, (sometimes called chemical attraction,) is that kind of attraction which unites the constituent atoms of compound substances. There are many kinds of attraction, but as we have but little to do with any except affinity in this science, it will be necessary to notice this only.

It is generally divided according to its application, into two kinds, called simple affinity and elective affinity. Also some again divide it into single and double elective affinity. These terms will now be explained.

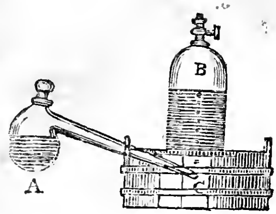
1. *Simple affinity* is that application of this kind of attraction, where two or more substances unite and form a new compound, without causing any decomposition.

Illustration. Mix oil, water and potash, or oil and liquid ammonia, and they will immediately unite and form a new compound differing from any of the constituents, and yet there will be nothing thrown off from a previous state of union.

2. *Elective affinity* is different; it is where two or more substances unite and form a new compound, to the exclusion of some other substance, from a previous state of union.

Illustration. Put into a retort, a small quantity of pearlash, chalk or marble. (The first of these is composed of *carbonic acid* and potash; the two last of the *same acid* and lime.) Turn into the retort a small quanity of sulphuric acid, diluted with *ten* times

its volume of water. There will be an immediate effervescence; carbonic acid will be given off in greater quantities, and may be collected as represented in the annexed figure. A is the retort, B the receiver, C the pneumatic trough with a shelf placed one inch below the top, and covered with water. The receiver being first filled with water, is placed on the shelf. The gas, as it is disengaged from the retort, passes through a hole in the shelf, and rises to the top of the receiver. Displacing the water, the gas may be transferred to a bladder attached to the stop cock by opening the cock and sinking the receiver in the water. The ground stopper at the top of the retort is to put in materials without displacing it.




EXPLANATION. The lime or potash has a stronger attraction for the sulphuric acid, which is an extremely strong acid, than it has for the carbonic acid, which is very weak; it *elects* it therefore,* unites with it, and forms the new compound, (sulphate of potash or lime,) to the exclusion of the carbonic acid, which was in a previous state of union.

3. When substances unite by this kind of attraction, i. e. affinity, their properties and sensible qualities are frequently very much changed.

ILLUSTRATION. Take a small quantity of muriatic acid in a glass, and put into it carbonate of soda as long as there is any effervescence. The result will be a solution of common table salt.

The muriatic acid is extremely sour and corrosive, so much so that it would take but a small quantity to destroy life, if taken into the stomach.

The soda also has energetic properties, in taste much like common pearlash; yet when they unite by this kind of attraction, the properties of both are changed, the acid loses all its acid properties, the alkali its peculiar properties, and this comparatively inert substance, common salt, is the result.

The salt is composed of muriatic acid and soda, (the proper name of it, *muriate* of soda,) and here these directly unite and form it.

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From the Mirror of the Patent Office.

## ANALYSIS OF THE LAW OF PATENTS.

SEC. 1. Patents, like all other monopolies at common law, are supposed to be against the policy of the state, and are founded on

* Hence the term, elective affinity.

statute. The rights of patentees therefore, depend entirely upon the laws of Congress.

Sec. 2. Patents can be obtained by none but native citizens, and their heirs and assigns, or aliens, who at the time of petitioning, shall have resided two years in the United States; unless it be by special act of Congress.

Sec. 3. The invention or discovery must be *new*. It must be *new* to him who applies for the patent. As, if he is conscious that it is not so, it would be perjury to take the oath required by law, viz: 'that he verily believes he is the true discoverer, or inventor of his said improvement.'

It must be *new* in fact. For if another person has made the discovery before; he, and not the one making the application, has the right to the patent, although he never has applied for it.

Sec. 4. It may be *new*, either in *principle*, or in the *method* of producing a good effect.

Sec. 5. It must not only be new, but *useful*. For if it be the discovery of an abstract principle merely, or of any thing resting in theory and speculation, and not connected with any useful purpose, it cannot be patented.

But the discovery of a *new employment* of principles already known, and in use, for new and useful purposes, entitles the inventor to a patent. So that improvements upon, or additions to, old arts, may be patented. But in such case, it is the improvement, or addition only, that can be patented. And such a patent gives no exclusive right to use the thing to which such addition or improvement is made.

Sec. 6. The form of the machine, for which the patent is claimed, is not material, if so be that it is well calculated to produce the designed effect, and the specification is such, that it can be used, and understood by a jury. Therefore, changing the form, or mode of constructing a machine, or instrument, to produce the same effect, is not the subject of a patent.

Sec. 7. Every invention or discovery, for which a patent is claimed, must be calculated, either to produce a *new* and *useful effect;* or to produce the *same effect*, which has been produced by others, in a *new* and *essentially better method*, than any other person has discovered.

Sec. 8. Patents may be assigned, and the assignment being recorded in the office of the Secretary of State, the assignee shall thereafter stand in the place of the original inventor, in the first instance, or in place of the assignor, if it has been before assigned, as the case may be, both as to right and responsibility.

Sec. 9. In case of interfering applications for patents, the law has expressly provided, that the right of granting the patent shall be decided by three arbitrators, one to be chosen by each party, and the third by the Secretary of State; and their award, or that of any two of them, shall be final, as respects the right of granting the patent.

SEC. 10. Patents void, or voidable, howsoever obtained, may be set aside by the District Court where the patentee, his executors, administrators, or assigns reside—by process in the nature of a quo warranto.

SEC. 11. Any person making, devising, using, or selling the invention of a patentee, without his or her consent; or that of his heirs, executors, or administrators, expressed in writing, shall forfeit a sum equal to three times the amount of the actual damage sustained by such patentee.

SEC. 12. In order to obtain a patent, the inventor must present a petition to the Secretary of State, who will, if the application appears to him to be well founded, cause letters patent to be made out, and submitted to the Attorney General, who shall certify and return them, if he finds the applicant is entitled to a patent. After which the patent is made out in due form, and given to the applicant, he having paid thirty dollars into the Treasury of the United States for the same.

SEC. 13. The application must be accompanied with a specification of the invention, whatsoever it may be, in all cases, and also with a suitable drawing and a model, if required: showing the manner of making, compounding, applying and using the said invention, in such a fair and express manner and form as to distinguish it from all others; and enable any person skilled in the art or science to which it belongs, or with which it is connected, to form and use the same.

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MESSRS. EDITORS—Being a young mechanic, and somewhat desirous of obtaining a knowledge of facts and precepts relating, not only to my own daily vocation, but to the arts and sciences in general; and believing that one of the most effectual means of obtaining this object is, to make known willingly, to examine candidly, and discuss freely with my brother mechanics, our principles and our practices, I send you the following observations upon a practical topic, which you may insert in the pages of the first number of your Magazine if you think they are deserving a place.

## LEAKY ROOFS.

LEAKY chimneys and battlements are no insignificant evils. It is too frequently the case that within three or four years after a building is finished, the storms begin to find their way into the interior, to the no small damage of the plastering and inconvenience of the occupant. This is an evil which might have been prevented, and one which can easily be remedied.

The cause of it is, the imperfect manner of fastening the lead

into the brick joints. Both slaters and masons in this city, generally use wooden wedges for fastening the lead, and fill the space in the joints not occupied by the wedges with loose mortar. In a short time the wedges will have decayed and the mortar entirely washed away, and there is nothing left to prevent the storm from driving under the lead, and thence through the roof.

If the following method of leading chimneys and battlements be observed, they will remain tight (extraordinary causes excepted) as long as the building will stand. The lead should enter the joint about one inch and a quarter; and the part thus entered should then be flattened closely down to the brick upon which it rests. The joint should then be filled with stiff mortar, which should be driven home to the back part of the joint with a piece of thin iron or hard wood; there will then be room in the joint for a second quantity of mortar, which should be driven home to the first; and this process should be repeated until the joint is perfectly full and solid.

Battlements and chimneys leaded in this manner will add credit to the mechanic, profit to the owner, and comfort to the occupant.

H.

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## SOCIETY FOR THE ENCOURAGEMENT OF MECHANICAL GENIUS.

'The products of a man's mind are as much his property as those of his hands.'

If this be true, ought not something to be done to secure the credit to those who spend much time and thought in perfecting useful inventions? The patent office is not adequate to this. It has been stated that very few of the patents would stand if tried in a law-mill. There are so many points to be attended to—such as originality, the oldest patent, the claiming of too much or not enough, the not being sufficiently explicit, and not furnishing proper drawings or models, &c. that the expenses of a law-suit are so frightful a poor man dare not engage in it.

Several plans have been proposed to effect this object. One is, for a company, after examining the project, to raise the needful to carry the plan into execution; said company to become co-proprietors.

I will take the liberty to propose a plan. Suppose a society were formed in Boston, with a small fund—say one or two hundred dollars a year. Let this society hire a room, or what is still better, procure one at the expense of the state, for a place of general deposit of the articles of inventors. Let them invite inventors from all parts of the state to send their plans, models, &c. to this room for examination by suitable committees, appointed on

various subjects. But, instead of giving the successful inventor a sum of money, give him a certificate, which will cost but a trifle, and he will thereby obtain a good name, which is better than rubies. Let this be done in public, and nothing will have a greater tendency to encourage him in his vocation. Publish an account of all the inventions annually. Undoubtedly such a book would sell well; and the community would thereby know the meritorious inventor from those that pirated other men's inventions. In a word, it would have a tendency to establish a correct feeling in the community.

I would take the liberty of proposing this as a subject for the consideration of the State Lyceum. A FRIEND TO MECHANICS.

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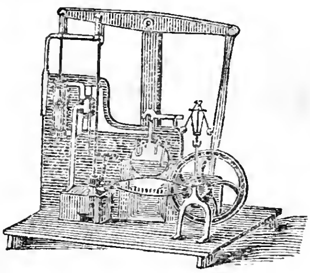

From the Education Reporter.

## THE STEAM ENGINE.

THE name of the *Steam Engine*, to most persons, brings the idea of a machine of the most complex nature, and hence intelligible only to those who will devote much time to the study of it.

But he that can understand a common pump may understand a steam engine. It is in fact only a pump, in which the fluid is made to impel the piston, instead of being impelled by it; that is to say, the fluid acts as the power instead of being the resistance. It may be described simply as a strong barrel or cylinder, with a closely fitted piston in it, which is driven up and down by steam admitted alternately from above and below from a suitable boiler; while the end of the piston rod, at which the whole force may be considered to be concentrated, is connected in any convenient way with the work that is to be performed.

The power of the engine is of course proportioned to the size of the piston and the density of the steam; that is, if the area of the piston be equal to one hundred square inches, and the density of

the steam equal to twenty pounds on the square inch, then the whole force against the piston will be two thousand pounds. In some of the mines in Europe there are cylinders and pistons of more than ninety inches in diameter, on which the pressure of the steam equals the effort of six hundred horses. The mechanical properties of steam are precisely like those of common air; hence any person, who is familiar with experiments in pneumatics, will readily see how the elastic force of the steam is capable of moving the piston in the cylinder of a steam engine; and how, by attaching a lever or other contrivances to the piston rod, motion may be communicated to pumps, mills, &c.

Those who are not familiar with such experiments, may try for themselves the following:—Take a goose quill, and a slice of potato, press one end of the quill on the potato, and cut out a piece which will be left in the quill; this may be blown by the breath to a considerable distance, or it may be pushed backward and forward in the quill, in imitation of the piston of a steam engine. The steam, after leaving the cylinder, is sometimes allowed to escape into the open air; this is called the high pressure engine, on account of the force of steam required to act against the pressure of the atmosphere.

In other engines the steam escapes from the cylinder into a vessel, kept cool by being surrounded with cold water. Here the force of steam is instantly destroyed; so that a vacuum is kept up on one side of the piston, while the whole force of the steam presses on the other side. This is called the low pressure, or condensing engine.

It is not an easy task to describe the manner in which the steam is made to act alternately at top and bottom of the piston, without a diagram, nor even with one, unless some parts are moveable. A real model of a steam engine, besides being very expensive, and many of the parts hidden from sight, is not easily managed by those whose business it is to teach. In consideration of the difficulties, a model (a figure of which is at the head of this article) has been contrived which is not very expensive, and easily managed. By this, a correct idea of the most essential parts of the steam engine may be easily obtained.

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## STOVES AND CHIMNEYS.

Messrs. Editors—As economy in fuel and the construction of chimneys, stoves, grates, &c. are of general importance to the community, particularly to mechanics, I send you a few remarks on the subject, believing they will be appropriate to your proposed Magazine. Wood, charcoal, bituminous and anthracite coal are

the combustions in most common use. Wood yields a cheerful blaze, and, like bituminous coal, is accompanied by smoke when the combustion is not complete. Anthracite coal and charcoal yield but little blaze and smoke, and are therefore better adapted for many purposes than any other combustible substance. The principle that governs the draught of chimneys is the expansion of the heated volume of air, whereby it becomes specifically lighter than common air, and has a tendency to ascend.

The great fault of all the open fireplaces or chimneys for burning wood and coal in common use is, that they are much too large, or rather it is the throat or lower part of its open canal, in the neighborhood of the mantle and immediately over the fire, which is too large; whereby a greater quantity of cold air is in the chimney than can be rarified by the fire on the hearth. The smoke is forced back into the room and the free combustion of the fuel is prevented. This is particularly the case where green wood is used for fuel. Were house-keepers generally aware of the loss attending the use of green wood for fuel, more care would be taken to procure seasoned wood—particularly for domestic economy. Mr. Bull of Philadelphia, found some sorts of green wood, 100 pounds of which contained 42 pounds of moisture. 2 1-2 pounds of wood are required to convert 6 pounds of water into steam. To convert the 42 pounds of water into steam required all the heat produced from the combustion of 17 1-2 pounds of wood. Deduct the 42 pounds of water, and the 17 1-2 pounds of wood required for evaporations, leaves only 40 1-2 pounds from which heat is obtained. To obviate the smoke of chimneys, stoves of various constructions have been introduced, not only to prevent the smoke, but having metallic pipes to transmit caloric more readily, and impart more heat from the combustion of all kinds of fuel than brick or stove flues. Where wood is used in stoves to which long pipes are attached, large fires of dry wood are necessary to prevent condensation of moisture within them. A portion of this moisture consists of pyraligneous acid—one of the most powerful acids for corroding metals. The anthracite coal yields no decaying acid or soot and but little ashes to coat the inside of the pipe. It will therefore appear that a sheet iron pipe connected with a stove in which anthracite coal is used will not only continue to yield heat more freely, but will last much longer than when wood is used for fuel. A great many stoves have been constructed for burning the anthracite coal. Messrs. Wilson & Co. of New York, have arranged their Pyramid and Franklin stoves with two series of sheet iron columns, the heat passing up those in front and down those in the rear. By this improvement, a large surface is exposed, through which the heat is transmitted. Dr. Nott of Schenectady has invented a stove for burning this coal, superior to any other now in use. Mr. Allen, in his work on the science of mechanics says, ' It is truly an elaborate production, constructed upon the most scientific principles applicable to the economical use of caloric. He has combined

science with taste in the arrangement of the parts of it. The lower portion, or pedestal, is formed of the best non-conductors of caloric to preserve the heat concentrated around the fuel, and to render the combustion perfect, while the external parts do not become heated so hot as to affect the air of a room unpleasantly. The upper portion presents to view the several pillars supporting an arch or canopy. The circulation of the draught of hot air through all the columns and other parts of the stove, exposes a surface equal to about forty feet of stove pipe, by means of which nearly the whole of the heat produced by the combustion of the fuel is imparted to the air of the room.'

Should this subject be acceptable, I shall make some remarks in your future numbers, on the heating of buildings with air and steam; and also upon using the anthracite coal for culinary purposes. W.

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## QUESTIONS.

At what distance from one end of a stick of timber 25 feet long should two men be placed with a hand spike, in order to support twice the weight that one man would at the extremity of the other end of the stick? P.

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Messrs. Editors—I have seen advertised for sale, a farm in the State of Maine, connected with which is a pond or river, which never freezes, even in the coldest winters. Being a *young mechanic*, I should like to know the cause of this; and as the answer may benefit others as well as myself, I would ask some of your correspondents to favor me with a solution of this apparent mystery. U. M.

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### TO CORRESPONDENTS.

We have received an article on Mathematical Instruments used by Draftsmen and Mechanics, for which the author has our thanks; it will be published in a series of numbers. An article entitled, 'The Perpetual Motion a Perpetual Notion,' is received. A Question relating to scholars in schools, one respecting apprentices, and another about several horses being killed by lightning, will probably appear in our next number.

We would call the attention of correspondents to the Questions published in this number.

THE

# YOUNG MECHANIC.

Vol. I. FEBRUARY, 1832. No. II.

## NATURAL PHILOSOPHY.

[Continued from page 7.]

### ATTRACTION OF GRAVITATION.

Gravitation is that force with which bodies tend towards the centre of the earth, or by which they fall perpendicularly to its surface.

Illustration. Gravitation seems to differ from corpuscular attraction, only as a part differs from a whole: the attractive power which singly unites the particles of smaller bodies, may form that gravitating power, in the aggregate, which governs the system of the universe; thus, considering the attractive influence of bodies as proportional to their magnitudes, the less will be governed by the greater, and those which are on, or near, the surface of the earth, will tend towards its centre. Bodies not only gravitate towards the earth, but likewise towards great elevations or mountains on different parts of its surface; for if a ball be suspended by a line, and placed on different sides of a high mountain, it will gravitate on every side towards the mountain.

The power of gravity gives the same velocity to all bodies; therefore, taking away the resistance of the air, or the medium through which they fall, the descent of all bodies from the same height will be performed in the same time, whether they be great or small, light or heavy.

Illustration. If a piece of gold and a feather, or any other bodies, the specific gravities of which are different, be dropped from a given height, through the atmosphere, the superior gravity of the gold will more effectually evercome the resistance of the air, than the inferior weight of the feather, and consequently it will fall much sooner to the ground; but if they both fall at the same instant, from the slip or dropper of an exhausted receiver, they will arrive at the bottom in equal times; for as the resisting medium of the air is here taken away, the bodies descend with equal velocities.

Falling bodies gravitate with an increasing velocity as they approach the surface of the earth.

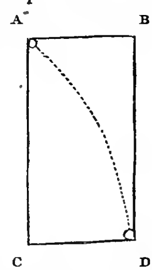
ILLUSTRATION. This accelerated motion is produced by the constant power of gravity, which, by adding a fresh impulse at every instant, gives an additional velocity and an increasing motion in every moment of time. The space through which a body falls by the power of gravity in the latitude of London, is 16 1-12 feet, in the first second of time, four times that distance in two seconds, eight times in three seconds, and sixteen times in four seconds; increasing in velocity according to the squares of the distance through which the body descends.

The law of acceleration in bodies descending perpendicularly, holds equally in point of time with those bodies that are projected.

ILLUSTRATION. If a stone be dropped from the top of a tower, and another of the same weight be thrown horizontally at the same instant, the two different bodies will reach the ground at the same moment of time. Even if a ball were fired with any force horizontally from a cannon, on the top of a tower, it would describe the line of its course in the same time that another ball would fall perpendicularly from the top to the bottom, supposing them to meet with no resistance from the air.

If a ball be dropped from the topmast of a ship, even supposing the vessel to sail through the water with a velocity of ten miles an hour, it will fall exactly at the bottom of the mast.

ILLUSTRATION. Let A C be the ship's mast, and its position when the ball is dropped from A; C D the distance sailed during the time of the descent; and B D the second situation, when the ball strikes the deck. Then the force, or projecting velocity of the vessel, C D=A B carries it towards B, and the force of gravity acts from A towards C; but the compound force carries the ball to D, in the direction A D, and in the same time that it would fall from A to C, if the vessel were at rest. And as the velocity of the ball and vessel are equal, it apparently drops perpendicularly down the side of the mast, as it describes the curve of projection; but a person in a vessel at anchor, at some distance, would observe its curvilinear direction.




The power of gravitation is greatest at the surface of the earth, and decreases both upwards and downwards, but in a different proportion.

ILLUSTRATION. In ascending, the gravity decreases as the squares of the distance from the centre increase; for at the distance of the earth's semi-diameter from its surface, the gravity is not more than a fourth of that power on its surface. The force of gravity downwards from the earth's surface, is in a direct ratio as the distance from the centre; for at half the semi-diameter from its centre, the power of gravity is only equal to half the power at the surface; at a quarter, one fourth; and so on for any given distance in like proportion.

## CHEMISTRY.

[Continued from page 9.]

### CALORIC.

Caloric is the matter producing heat, not heat itself; thus, when we put the hand near any warm substance, we feel a particular sensation. That sensation is termed heat or warmth; it is supposed to be caused by caloric which is thrown off, or passes from the warmer substance, and enters the hand; and by its action upon it, produces this sensation. Cold is merely a negative quality, signifying only the absence or dimunution of caloric; thus, when we feel the sensation of coldness, caloric passes from us into surrounding substances, and the more rapidly it passes, the more exquisite the sensation.

Though caloric is the matter producing heat, yet it can exist under certain circumstances, in such a state as to lose this property; it is then called combined caloric, sometimes latent heat. These terms both mean the same thing; i. e. that state of that principle which under ordinary circumstances, will affect the thermometer—will produce the sension of heat—will burn—is fire. They mean that state of this principle when it has lost this property. *Combined* caloric, therefore, may be said to be that state of caloric when it will not excite the sensation of heat, or affect the thermometer. *Free* caloric, that state of the same, when it will excite the sensation of heat and affect the thermometer.

Caloric is supposed to exist in this state of combination, in union with all material substances; in the largest quantities, in aeriform bodies—substances in mechanical properties like the common air; next to these in liquids, and least in solids. This being the case we should of course infer that if we took any substance in an *aeriform* state, and changed it from that state to that of a *liquid*, or a liquid into that of a solid, that a portion of this caloric would be given out and become free, or that there would be an increase of temperature. Or if we took a solid substance, and changed it into a liquid, or a liquid into an aeriform body; that a portion of it would be absorbed, and that (other circumstances being equal) there would be a *decrease* of temperature; which is the case as we shall see by reference to experiments hereafter.

4. That it does exist in this state, and that it can be brought from this to that of free caloric—from that state in which it will not excite the sensation of heat, nor affect the thermometer to that state in which it will do both, may be seen by reference to some experiments.

If what has been said is correct, it of course exists in this state in common air; and that it does exist in this state, and that it can be brought from this to a free state, simply by compression, may be seen by means of what is called a fire syringe. A metallic tube, made tight at one end, the other end left open; into this is inserted a piston, which plays perfectly air tight; upon the end of

this piston is a small quantity of tinder; which may be prepared by wetting cotton wool in a strong solution of nitrate of potash (common salt petre) and afterwards thoroughly drying it, or what answers equally well, a small piece of phosphorus wrapped in cotton wool. By forcibly pressing this piston down, the tinder will be inflamed. The reason is this; here the air is very much compressed; the air which filled the whole of the tube being compressed into a very small space at the bottom, it is of course rendered more dense; more nearly resembles a solid, than it did before being compressed; in consequence of this, less caloric is needed in this state of combination; a part of it is pressed out and becomes free, and when free, it produces the same effect as caloric radiated from combustion; i. e. it inflames the tinder.

5. That it exists in liquids, in this state, and that it can be brought to a free state upon the same principle, may be shown by mixing liquids which have a strong attraction for each other.

Illustration. Take two wine glasses, *one* half filled with water, the *other* with oil of vitrol, both *cold;* mix the liquids, and the temperature will immediately rise to nearly or quite the boiling point. All the caloric, however, which thus raises the temperature, existed in the liquids before they were mixed in a state of combination; but when mixed, in consequence of their great attraction for each other, they become more dense, and a portion is pressed out and becomes free.

That they do become more dense, may be known by the fact that they occupy a less space after being mixed than before: i. e. take any two measures, one of oil of vitriol and the other water, say a glass of each, mix them and they will not make *twice* as much; i. e. a *gill.*

6. The same principle holds good when liquids are changed into solids, and *vice versa.*

Illustration. Put water on unslaked lime, and much heat will be given out, as the lime undergoes the process of slaking.

Here, a portion of the water becomes solid, and gives out its combined caloric.

That the water does become solid, may be ascertained by weighing the lime, *before* and *after* slaking, not allowing anything to come in contact with it, but the water, and yet it will be found to increase in weight during the process; as all we have after it is slaked, is perfectly dry and solid; and as it weighs more than before, it of course shows that a portion of the water must have become solid.

7. When solids become liquids, and when liquids become aeriform bodies, there is (owing to the same principle) a decrease of temperature. For, as it requires a larger quantity of caloric, in this state of combination, to keep any substance in a *liquid* state than it does to allow it to exist in a solid state; and also to keep any substance in a gaseous or aeriform state than in that of a liquid, whenever these changes take place, caloric is taken from

surrounding bodies unites with them, and loses the property of exciting the sensation of heat, and of course in the vicinity the temperature is lowered.

Illustration. Mix snow and salt in a small vessel, and stir the mixture with a thin, small vial, having in it a small quantity of water; while the *solid* snow and salt are melting the water in the vial will *freeze;* illustrating the fact, that when solids become liquids, there is a decrease of temperature.

Illustration ii. Put on the bulb of a large air thermometer, a small quantity of sulphuric ether, boiling hot. (The ether may be heated by warming a wine glass and turning the ether into it.) Although the ether is thus hot, it will produce the same effect on the thermometer as ice; for in consequence of the rapid evaporation, i. e. the change from the liquid to the aeriform state; much caloric must unite with it, and lose the property of exciting the sensation of heat.

The air thermometer may be made by taking a bolthead, having a long, slim neck; warm it a little, and place the end of it in a decanter, partly filled with any colored liquid; as it cools the liquid will rise in the neck. It is on this principle, that sprinkling the floor of a room in hot weather, or wrapping bottles of wine or cider with a wet cloth, will tend to decrease the temperature. Also the paradoxical experiments of freezing persons, by turning boiling hot ether upon them, keeping them in a hot place.

As has already been stated, we must examine the substances in this class, by noticing the effect which they produce upon other substances, as they cannot be confined and submitted to the usual method of examination. We may, therefore, in the next place, refer to some of the effects which caloric produces upon other substances; and first may be illustrated this fact.

8. More caloric is required to cause any liquid to boil, when the surface of such liquid is exposed to the pressure of the air, than if this pressure, or any part of it, is removed.

Illustration. Fill a Florence flask one third full of water. Fit a sound cork to the mouth of it, so that it will make it perfectly tight, leaving the stopper out, place the flask over a spirit lamp and allow it to boil. Then remove the heat and *immediately* make the mouth of it tight. Then by turning cold water, or putting ice upon the outside, it will cause the liquid in the vessel to boil rapidly.

The reason is this, when the water boiled in the first place, a part of it was converted into vapor, its volume being increased, it drove out the atmospheric air which filled the upper part of the vessel, so that when the cork was inserted, the upper part of the vessel was filled with the vapor of water. Cooling this condenses it, brings it back to the state of water again, and causes it to occupy a less space; but as the mouth of the flask is tight, air cannot come in to press upon the surface of the water, and this is the reason why the water boils at so low a temperature.

## OBSERVATIONS ON DRAWING INSTRUMENTS.

Before the student commences the study of the theory and practice of drawing, it is supposed that he has made himself acquainted with the first principles of Plane and Solid Geometry; indeed, if he has not, he can never expect to arrive at any perfection in this useful and pleasant occupation. A knowledge of geometry is one of the prerequisites attending the study of drawing, so much so, that a person cannot be too great an adept in that science before he begins. It is much to be lamented that such a deficiency of knowledge in this respect, prevails among many who profess to be architects and draftsmen, but whose works proclaim their entire ignorance of the subject, being as it were a confused collection of lines, crossing one another in every direction without any meaning, and capable of being understood only by those whose fertile geniuses have produced them. By geometry the draftsman is taught to place every line on his paper in its true proportion to that of which it is the representation, to decide with certainty what will be the appearance and effect of his plan when finished, as well as if the edifice were really existing in the situation in which his imagination has intended it to be placed. Without geometry, the picture is drawn, as it were, by guess—it has no determinate points or lines, or any other guide than the judgment of the eye. The effect of the whole will be unnatural and disagreeable, tending to mislead the workman, and to deceive him into errors for which he cannot account. It is not necessay that the architect should possess a knowledge of this science alone, although he may have the soundest judgment and the most extensive experience, nevertheless it will require a good taste and a good hand to complete and finish the work, for it would be tiresome and endless in many cases to apply the rules of geometry to all the minutiæ, as the leafy capitals of columns, the ornaments in the entablatures, the infinite variety in the folds of drapery, &c.; much more to give them that roundness, softness, and beauty of effect which is requisite to make a good picture. These will not owe much to geometry, but will be principally indebted for their value to the taste and judgment of the draftsman.

### ON MATHEMATICAL INSTRUMENTS.

As it is extremely necessary for the student to be made acquainted in the first place with the construction and use of those instruments, by the means of which he is enabled to make a perfect drawing, and to be able to repair them when they may get out of order, it is hoped that by strict attention to what follows, he will so far inform himself, after a little practice, as to surmount any difficulties which may occur in this respect.

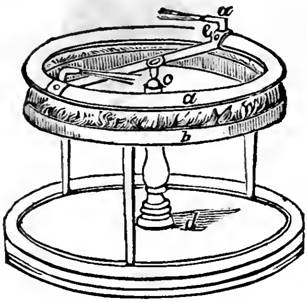
Drawing instruments may be divided into several kinds. First —Those for drawing lines—as pens, pencils, crayons and steel pens. Second—Instruments for guiding or directing the above—

as rulers for drawing straight and slightly curved lines, compasses for drawing circles, trammels and elliptic machines for describing ellipses, and the geometric pen for producing a great variety of curves. Third—Those which are used for marking or setting out distances, or dividing them—as compasses and plane scales, sectors and protractors, also, instruments for dividing circles or elipses.

As it is customary with every artist whose operations are connected with mathematical designing, to furnish himself with a collection of drawing instruments, the best adapted to his particular purposes, they are fitted up in various modes, some containing more, others fewer instruments. What is considered as a complete case, and which is generally the best in use, and such as may be obtained at almost every store, comprises the following articles: a pair of large compasses with shifting leg, an inch point, a pencil point, and one for dotting. Either of these points may be inserted in the compasses instead of the moveable one. A pair of plane compasses, somewhat smaller than the other, for measuring distances; a steel drawing pen, the handle of which unscrews and contains a fine steel point for protracting; a small pair of bow compasses for describing very small circles; a bow pencil for the same purposes; a sector, the use of which will be explained hereafter; a plane scale, which has lines graduated upon it with equal divisions of different values; a protractor or semi-circle, divided into degrees for laying down angles; a parallel rule; a black lead pencil, with a silver ferule on top, formed like the blade of a penknife for scratching out or tracing lines on the paper.

In the best cases of instruments the protractor and plane scale are always combined. Those instruments in general use are seldom more than six inches in length, but often smaller. The former are commonly preferred to any other size; they will effect nearly all that is necessary. There are also larger collections of instruments, called *magazines*, many of which contain a great number, and which are moreover very expensive, and of so very little use, comparatively speaking, that they will hardly compensate the student for purchasing them. These generally contain in addition to those before enumerated—several pieces to lengthen occasionally one leg of the compasses, and thereby enable them to measure greater extents, and describe circles of larger radii; a pair of hair compasses; a pair of triangular compasses; a pair of proportional compasses, either with or without an adjusting screw; a pair of wholes and halves; a knife, file, key and screw driver, all in one piece; a pair of beam compasses; a pair of elliptical do.; a pair of spiral do.; a pair of perspective do.; a pair of compasses with micrometer screw; a centrolinead, or rule for drawing lines tending to a centre at a great distance; one or more rolling parallel rulers, a pentagraph, besides numerous other minor instruments.

(To be continued.)




## FIRST STEAM ENGINE.

For a long time the reputation of the first discoverer of the steam engine was accorded to the Marquis of Worcester. But it was afterwards discovered that Branca, an Italian of some celebrity as an author and philosopher, had anticipated the Marquis some years in the application of this power to machinery. This was supposed to be a final settlement of claims in regard to this subject. But quite recently it has been discovered that a new claimant to this distinguished honor, appears in Hiero of Alexandria, who flourished about a century before the commencement of the christian era. And now we shall not be much surprised if finally it should be traced back to Tubal Cain, that cunning antedeluvian worker in metals.

Mr. Partington lately exhibited a model of Hiero's steam engine, made by Mr. Styles, to a London audience, of which the annexed figure is a representation. The upper circumference of the machine, *a*, is filled with water, and supported on the pillar *d*, at the top of which it turns on the pivot *c*. The water being boiled by the flame of alcohol in the trough *b*, the steam issues rapidly from the small apertures as at *e*, and the opposite extremity of the transverse diameter, and the machine continues to revolve on its axis as long as heat be applied, and it contains water. WATT.

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## THE FIRST SAW MILL.

The old practice in making boards was to split up the logs with wedges; and, inconvenient as this practice was, it was no easy thing to persuade the world that it could be done in any better way. Saw mills were first used in England in the fifteenth century; but so late as 1555 an English ambassador having seen a saw mill in France, thought it a novelty which deserved a particular description.

It is amusing how the aversion to labor-saving machinery has always agitated England. The first saw mill was established

by a Dutchman in 1663, but the public outcry against the new fangled machine was so violent, that the proprietor was forced to decamp with more expedition than ever did Dutchman before.

The evil was thus kept out of England for several years, or rather generations; but in 1768 an unlucky timber merchant, hoping that after so long a time the public would be less watchful of its own interests, made a rash attempt to construct another mill. The guardians of the public welfare, however, were on the alert, and a conscientious mob at once collected and pulled the mill to pieces. Such patriotic spirit could not always last, and now, though we have no where seen the fact distinctly stated, there is reason to believe, that saw mills are used in England.—*N. Y. paper.*

One of the conductors of the Young Mechanic visited Portsmouth (Eng.) Dock Yard in 1812. At that time the Block Machinery contrived by Brunel was in operation. The sawing of the large timbers was performed by the steam engine; there were pit saws, cross-cut saws, circular saws, mortising chisels, and a variety of other contrivances for finishing the blocks, all put in operation by steam.

A large steam saw mill has been erected near the city road, on the regent's canal, London. In Westminster, and several other places in and about London, saw mills are in operation, and no doubt in the manufacturing districts.

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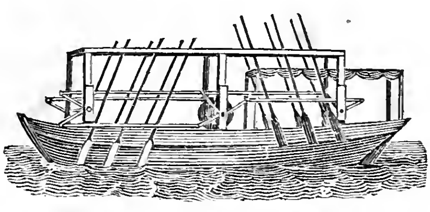

## THE FITCH STEAM BOAT.

We have procured the engraving of an early Steam Boat, the contrivance of John Fitch, clockmaker of Philadelphia. Several experiments were made on the Delaware at Kensington in 1788. The machinery was constantly getting out of order. A few friends who had patronized him grew disheartened, and he was obliged to relinquish the undertaking. This was twenty years before Fulton made his successful experiment on the Hudson. Fitch's boat was propelled by twelve oars; six of them came out of the water, while the other six entered the water. The cylinder of the engine lay in a horizontal position. The piston rod was attached to suitable levers, axle, &c. Fitch retained full confidence that the scheme was a feasible one to the end of his life. He observed to some friends who listened to him without faith, 'Well, gentlemen,

although I shall never live to see the time, you will, when steam boats will be preferred to all other means of conveyance, especially for passengers; and particularly on the Mississippi.' He then retired; when one exclaimed with deep sympathy, 'Poor fellow! what a pity he is crazy.'

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From the 'Industriel,' and Gill's Technical Repository.

## ON TINNING CAST-IRON WEIGHTS.

These are first to be well rubbed and cleansed in a bath of sulphuric acid, (*oil of vitriol*) which has been diluted with a proper quantity of water. After this preparation, they are to be dipped into water, in which sal-ammoniac has been dissolved, in the proportion of one-seventeenth of the salt, to the quantity of water employed. During these operations, we melt fine and pure tin, with which has been previously mixed copper, in the proportion of three ounces of this latter metal to one hundred pounds of the tin. When the mixture has been melted at a proper degree of heat, not so high, however, as to hinder it from attaching itself to the pieces of cast-iron to be tinned, they may be plunged into it.

The weights should be previously turned into shape, in the lathe, and be made smooth before tinning them; and when they have become cold, after the tinning process, they may be polished in the lathe by means of burnishers in the usual manner.

In order to render the three ounces of copper easily fusible in the tin, it should be previously melted with six pounds of that metal, taken from the one hundred pounds.

This tinning of the weights is designed, not only to preserve their size and weight better, but also to prevent them from rusting; and we can thus substitute these cheap cast-iron weights, in the room of the more expensive ones of brass or copper.

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## THE PERPETUAL MOTION A PERPETUAL NOTION.

Mechanics seem to be as far from solving the question relative to a perpetual motion as they were two thousand years ago; and yet many of them are still troubled with the old mania. No reasoning will deter them from the pursuit. I suppose the reason why those that know better do not endeavor to stop this kind of speculation is, that they think as Bishop Wilkins did two hundred years ago, when he compared them to the man who dug the vineyard for a hid treasure, and, although he did not find it, yet made the ground more fruitful. Working at models of this kind is certainly a very expensive and tedious way of studying the science of mechanics. Reading and attending lectures with experiments are much better. The Academy of Sciences in Paris have resolved that they will have nothing to do with pretended discoveries of a

perpetual motion; they have decided that the invention is impossible, and that all attempts at the discovery of it are a mere waste of time. The quadrature of the circle, and the trisection of an angle are also, in their opinion, problems impossible of solution. There is a wide difference between a perpetual motion and a self-mover. The former moves perpetually, and may be any human contrivance put in motion by the ebbing and flowing of the tides, the waters of a never failing cataract, variations of the atmospheric pressure, expansion and contraction of metals and other bodies; in fact, any motion that the great Author of nature has made, will, if we can hook our machine to it, serve this purpose. But the latter, a self-mover, show me one. I will enclose it in a box, and ask this question, does this machine move without the aid of any cause beyond the limits of this box, and yet, after it has moved for a definite length of time, appear as likely to continue as it did at first? There are only two kinds of motion with which we are acquainted—mechanical and chemical. In all mechanical contrivances, there is a loss of power. It is a general rule to make allowances for friction in the steam engine; and it is common to allow one-third of the power of the steam for the friction of the engine. One pound of power applied to any machine whatever, will not raise a pound weight through as much space as itself descended. Motion occasioned by chemical action must come to a stand; for the materials acted upon are continually undergoing decomposition, or are altered in such a manner that they do not return to their former state, and in the same place. In illustration of this, take the steam engine for an example. The fuel of the fire is acted on chemically, and is decomposed, and no art can return it to its former state. So of the water in the boiler; although the steam will return to the state of water, yet some of it will be decomposed and form an oxide on the sides of the heated metal. Another portion will escape beyond our reach. Gun-powder is a source of great power, but the materials of its composition are dissolved in one discharge. For fear of being tedious, I will conclude with a brief quotation from Mr. Banks: 'When a man tells me he can construct a water-wheel in such a manner, that when once put in motion it shall raise water to keep itself moving —or that he has constructed a pump in such a manner that one man may do the work of ten; I pay the same attention to him as if he told me he could create a system of worlds, and command them to move.' PHILO.

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## IMPORTANCE OF TRIFLES.

It is a fact that some curious arts cannot be transported but by the workman himself. Most men will learn better by seeing the operation, than by reading or any other method. This is illustrated in the following statement of a glass trinket maker of

Birmingham, England, and is in substance as follows: 'Eighteen years ago, on my first journey to London, a respectable man asked me if I could supply him with doll's eyes; and I was foolish enough to feel half offended; I thought it beneath my dignity to make doll's eyes. He took me into a large room, and from the immense number of legs, arms and trunks, I was convinced he wanted a great quantity of eyes. He gave me an order amounting to upwards of £500. On my return, although I had some of the very best workmen in the glass-toy line, yet, they shook their heads, said they had seen the article before, but could not make it. I offered them great inducements to try their best, and after wasting much time the project was abandoned. Within a few months, however, I turned my attention again to the doll's eyes, determined to make them, if possible. After a while I met by accident a poor fellow, in poverty from drinking, and dying of a consumption. I showed him ten sovereigns; he said he would instruct me in the process. He could not bear the smell of his own lamp, and though I was well acquainted with such work, I felt that it could not be done from his description. He took me into his garret, and before I had seen him make three I felt competent to make a gross; and the difference between his mode and that of my workmen was so trifling that I was astonished.' TRIFLE.

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## JAMES BRINDLEY.

This celebrated engineer was entirely self-taught in even the rudiments of mechanical science, and to the end of his life was barely able to read, or write except to sign his own name.

He was born in Derbyshire, in 1716. His father having wasted his property, young Brindley was obliged to labor almost from his infancy. At the age of seventeen, he bound himself apprentice to Mr. Bennet, a millwright at Macclesfield. Here the superiority of his genius unfolded itself. In a short time the millers placed more confidence in his opinions than in those of his master, and such was his devotion to his business, that for the purpose of obtaining correct information about a paper-mill, he visited a mill at the distance of fifty miles, between Saturday evening and Monday morning; this being the only time he could spare.

His reputation continued to increase until he attained the age of forty. It was at this period that the duke of Bridgewater required his assistance for his projected canal. Here his genius found its proper field, in planning and executing that great work. He however accomplished all the parts of his undertaking in a manner, not only satisfactory to his employer, but with such display of talent that succeeding engineers have constantly referred to his works as models for imitation. The strength of his genius is made the more apparent when it is considered, that his profession, more than most others, requires mathematical learning.

When any great effort of his mind was required, it was his custom to retire to bed, where he remained until his task of invention was accomplished, which sometimes lasted two or three days; when he would get up and put his design at once into execution. One of the difficulties Brindley had to encounter, was to carry a canal over the river Irwell, without interfering with its navigation. But nothing could dismay him. Thinking, however, prudent to give his employer the best evidence in his power of the practicability of his design, he requested that another engineer should be called in to give his opinion. This person being carried to the spot, Brindley explained to him how he meant to carry on the work. But the man only shook his head, and remarked, that 'he had often heard of castles in the air, but never before was shown where any of them were to be erected.' The duke, nevertheless, retained his confidence in his own engineer. The work proceeded, an aqueduct was erected over the river supported by three arches, on which a vessel might be frequently seen passing along, while another, with all its masts and sails standing, was holding its undisturbed way directly under its keel. Alluding to the Hare-castle tunnel a writer observes, 'Gentlemen, come to view our eighth wonder of the world, the subterranean navigation, which is cutting by the great Mr. Brindley, who handles rocks as easily as you would plum-pies, and makes the four elements subservient to his will. He is as plain a looking man as one of our boors of the Peak, or one of his carters, but when he speaks all ears listen, and every mind is filled with wonder at the things he pronounces to be practicable.' This man's total want of education left his genius without any other field to exercise itself and spend its strength than that which the pursuit of his profession afforded it. Its power, even here, would not probably have been impaired if it could have sought relaxation in variety; on the contrary, its spring would most likely have been all the stronger for being occasionally unbent. Mr. Brindley died at the age of fifty-six years.

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## HINT ON PRESERVING THE SOLES OF BOOTS.

My boots being damp the other day, I placed them on the top of an iron stove, with the intention of their remaining a few seconds only. Being suddenly called away on other business, I forgot my boots. When I returned they were pretty well roasted. Being afraid they were spoiled, I applied lamp oil to the burnt part until it would receive no more. This was to keep them from cracking. Since that time they have been more impervious to moisture, very hard, and I have no doubt will wear the longer for it. I have been told by a first rate bootmaker that linseed oil would have been better. This hint may be improved by others.

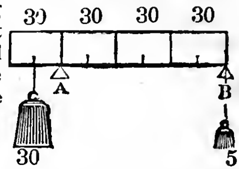
ECONOMY.

## ANSWERS.

We have received several answers to the question concerning the stick of timber, and have selected the following. The others are not correct.

In answer to this question I would say, the hand spike must be placed at one-fourth the length of the stick from the end, which is six feet three inches.

The explanation is as follows: Divide the stick into four equal parts, as in the annexed figure. Supposing the whole weight to be 120 pounds, each part will be thirty pounds. The hand spike is placed at A, and the man at the extremity B. Now, if we suppose that part of the stick to the left of A to be removed, there will remain 90 pounds to be supported equally by A and B, and 45 pounds by each. We will now estimate the effect of that part on the left of A. This is done on the principle of the lever or weighing balance. The weight of this part, or 30 pounds, is concentrated in the middle of the part, or where there is represented a weight of 30 pounds hanging. The effect of 30 pounds at this point would be to support 5 pounds at B; because the distance from the fulcrum at A to B, is six times as great as the distance from the fulcrum to where the 30 pounds weight hang. By this operation, the load on B is reduced to 40 pounds, or one-third the weight of the stick. It follows from this, that, in addition to 45 pounds and 30 pounds, this 5 pounds taken from B must be added to A, which will make the load on A 80 pounds, or two-thirds the weight of the stick. FORE PLANE.




Messrs Editors—In answer to the inquiry of U. M., respecting the pond or river, which never freezes, I would observe, that I was as ignorant of the cause as himself, until within a few months past, when I saw the following reason given in the second part of Arnott's Physics. 'Water, exposed to a keen frost, will not harden on the surface, like the ground; but the surface, which is the part exposed, will be cooled, and descend, from its being in a denser, or heavier state, and will force up the warmer water, to take its place; this in its turn is cooled and descends, and a continued circulation is established, so that the surface cannot become ice, until the whole mass, of whatever depth, is cooled down to its greatest density. Hence, the very deep sea is not frozen in the coldest climates, and in the temperate climates the severest winters do not freeze even a deep lake.' Therefore this pond, or river, in the state of Maine, is probably so deep, that the whole mass does not become cooled to the freezing point, before it is checked by the return of spring. I hope that this explanation will solve the mystery in the mind of U. M. as it has in my own. J. M. W.

## QUESTIONS.

Messrs Editors—I wish to inquire through the medium of your Magazine whether some method cannot be adopted for killing neat cattle different from the one in common practice. Surely it would seem to a reflecting mind, that some other plan might be pursued contrary to that of knocking out their brains, or that which is nearly as barbarous. I

think any person who has seen one of these useful animals knocked on the head, as they frequently are, a number of times before they can be brought to the floor, and hears the moans of the poor animal, must be convinced of the barbarity of the practice. I have frequently spoken to butchers on this subject, but have always received for answer, that no better method could be substituted. But their saying so does not prove it. Almost every branch of mechanical business has been improved within a few years, and I do not see any good reason why there cannot be improvements in this. The subject cannot be called an insignificant one, when we take into consideration the great number of cattle killed in the course of a year, merely in the vicinity of Boston. In one slaughter-house alone there are killed in the fall of the year, from sixty to eighty head a day. Now my idea of this matter is, that if the patient, the ever toiling ox, is to be slaughtered, it should be done by occasioning as little pain as possible. I hope that some of your enlightened correspondents will consider the subject worthy of attention, and communicate their thoughts through your useful periodical, and much oblige a friend to humanity. BRIEF.

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WHAT method could be adopted in a grist-mill, so that the miller should take neither more nor less than his proper toll; let the quantity of grain be what it may?

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THREE seamen sat down to a frugal meal. A had 3 biscuits, B 4, and C 5. D came up at the time, and these four men partook equally of said biscuits. D put down six cents for what he eat. How should the money be divided?

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MESSRS EDITORS—I should be pleased if some of your correspondents, would inform me through the pages of the Young Mechanic, the cause of several horses being killed by lightning last summer, while the persons remained unhurt in the carriages to which the horses were attached.

PHILO.

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Required, the best method of managing an apprentice to a mechanical trade, so as to give mutual satisfaction; the lad to have a chance to improve his mind, appear respectable, and when free to own one hundred dollars? A MASTER MECHANIC.

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## NOTICE TO INVENTORS.

BY a recent regulation in the patent office, no letters patent will be issued without the specification is accompanied by a good model of the invention for which an exclusive property is solicited.

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## STATE LYCEUM.

THE annual meeting of the State Lyceum was held at the State House on Thursday evening, Feb. 2. Extracts from highly interesting reports from the various county and town Lyceums were read; and several gentlemen addressed the meeting in behalf of the Lyceum system of education. The meeting was adjourned to Monday evening, when it was addressed by Mr. Woodbridge on the National Lyceum and by Mr. Calhoun on the subject of common schools. The following preamble and resolution important to young mechanics were unanimously adopted:

'Whereas in the opinion of this meeting, many of our enterprizing mechanics, for want of scientific knowledge, suitable books, and proper advice, frequently incur an expense of time and money to very little profit, in endeavoring to perfect useful inventions, which might have been avoided, in part at least, by timely application to some person competent to judge of their merits; and whereas it is believed to be in the power of this Lyceum to do something towards removing this evil; therefore,

'Resolved, That this Lyceum adopt measures to remedy this defect, by appointing one or more committees of advice, procuring a place of deposit, inviting inventors to send in their plans, models, &c.—and by such other means as may be deemed expedient and practicable, to endeavor to promote the object.'

This resolution was unanimously adopted after some discussion, and referred to the Curators to be carried into effect, in such manner as they may deem expedient.

## TABLE OF MECHANICAL MOVEMENTS.

Mr. S. N. Dickinson published some time since, one of these tables. We think this table with the explanations, peculiarly adapted to persons engaged in the construction of machinery. Certainly very few, if any, of our mechanics are in possession of a library that contains near so many useful diagrams. If this sheet were put up in a convenient place in a work shop, or counting room, or even a lecture room, many persons would become familiar with various combinations of wheels, levers &c. the existence of which were before unknown to them.

A new Steam Engine.—A patent has been obtained for a new steam engine, in Philadelphia. It entirely dispenses, not only with the lever beam, but nearly all the valves, rods and wheels, that render the ordinary machinery of steam engines so complex. The movements are remarkably perfect and easy, and make but little noise.

New light.—We called last evening at the Congress Hall, (Wells's Hotel) to see in operation a newly constructed Lamp, by which a clear, beautiful light is given without the aid of wicks, or rather without the hindrance of wicks. Common oil is placed in the bowl of the lamp, and is made to produce gas for the light. The construction is simple, and it is said the consumption of oil is 50 per cent. less than in the usual mode of lighting rooms. The lamp is worthy the attention of the curious.—*U. S. Phil. Gaz.*

## TO CORRESPONDENTS.

'An Essay on the claims of the Mechanic Arts, and the causes of their slow progress,' is very acceptable: also 'Patents of Massachusetts granted in January, February, March and April, 1831.'

The conductors are in want of articles on a number of subjects not yet treated upon. They request those who have articles prepared on any subjects adapted to this work, to send them in as early as convenient.

An abstract of the proceedings of the late convention of farmers, mechanic, and other working men, held in this city, will probably appear in our next.

THE

# YOUNG MECHANIC.

Vol. I. MARCH, 1832. No. III.

## OBSERVATIONS ON DRAWING INSTRUMENTS.

[Continued from page 23.]

In our observations on instruments, we shall begin with those employed in drawing lines; and of these the first which comes under our notice is the black or red lead pencils. It is very material that the student should be so far acquainted as to select the best for his use. They should be of the purest lead, without the admixture of any hard or gritty particles. The hardness of the pencil should be adapted to the purpose for which it is used. For all kinds of mathematical drawing, when the lines are to be traced over afterwards with ink, they should be hard, of an even temper, and quite black, should always be kept cut to a very fine point by means of a knife, or what is much better, a fine file; should be able to preserve the sharpness, and at the same time, should mark with so little pressure that it will not penetrate or indent the paper. This is highly essential in the pencil, for if it require much exertion to erase the marks with the India rubber, the surface of the paper becomes rubbed up, and the filaments catching in the pen prevent it from drawing fine lines, or the color from laying smooth. Some pencils are made by reducing the lead to a very fine powder, and recomposing it by the aid of some gelatinous substance. By this means the impurities of the lead are separated, and sometimes very good pencils are produced, but these can never be brought to so fine a point as those made of the solid lead. Those made of the Cumberland lead are generally esteemed the best in England. Messrs. Brookman and Langdon of London, and Joseph Sewall of Liverpool, have invented processes for purifying the lead so as to produce pencils of any required temper. Cunningham's pencils, and Cowen's of New York, are the best manufactured in America. With respect to hardness, the makers distinguish them by the following marks:—Treble hard, hard in the highest degree, marked H H H. Double hard, for surveyors, etc. marked H H. Hard, for short hand etc. marked H. Medium, for drawing, writing,

etc. marked F. Hard black, for ditto, softer than F, marked H B. Black, for shading, etc. still softer, marked B. Deep black, for dark shading, softest, marked B B.—*Chalk.* Double, hard gray, marked H H C. Hard, black gray, marked H C. Soft, black, marked S. Double soft, intense black, S S.

All these marks are of a very superior kind, particularly the H H, which wear at the point so little, that it is scarcely necessary to cut them more than once or twice during the day. The point will frequently wear so as to draw a broad line. When this occurs it is better to sharpen it by the file than by the knife, as in the latter case we are very liable to break off a large portion of the lead, if we are not extremely careful. Some use for this purpose a piece of very fine glass or emery paper. The best pencils that the writer has ever used, are those made by Dobbs & Co. London. The student cannot be too careful in the selection of his pencils, for on them depend in a great measure the beauty and accuracy of his drawing.

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## ESSAY ON THE MECHANIC ARTS.

In considering the claims of arts and manufactures, the first inquiry which presents itsself to the christian or the philosopher, relates to their tendency to advance or retard the best interests of human society. The mechanic arts have been truly said to contribute to the general promotion of intellectual progress, by lessening manual labor, thus leaving the mind free to act.(1) But this is but a secondary benefit; they claim the attention of man as means of bringing into action the mental and physical powers of his nature. Nothing can be more obvious,than that peculiar adaptation in man's animal frame which makes it the organ of the mind. While the intellect conceives and the imagination portrays, it is for the hand to obey the will,and embody what before was only evident to the mental vision. It is well known that the first rudiments of mechanical philosophy were derived from nature. The wonderful adaptation of means to ends, and the evident marks of design exhibited in the works of creation, instructed and incited men's inventive faculties; and to this source we may justly ascribe the attainments made by the power of human art. But nature incites and improves, not only by the instruction conveyed in her laws and operations, but in the material she affords for the exercise of mind. It may be questioned whether nature has not been too much regarded as a means of improvement, in a general sense; whether man has not been too well satisfied in merely listening to her 'teachings,' and less anxious to apply her principles and bring into action her latent energies: in short, to make the laws and productions of nature the materials for the ardent and energetic exercise of the intellect.

It is evident that talent, among us, inclines, in its development, to literary and professional pursuits; and this can be reasonably accounted for from the fact that the great engine of civilized society, public opinion, has not in our community exerted an in-

fluence decidedly in favor of the mechanic arts as objects of general enterprize and intellectual research. This adverse tendency in the public mind may partly be attributed to the baneful effects which have arisen in England from the extensive introduction of manufacturing establishments. But it may be fairly doubted whether these effects must necessarily accrue in this country, differing as it does from the old world in its republican institutions and consequently in the tone of public sentiment. At least we may hope to profit by the experience of Great Britain, and escape those errors which have entailed upon her so much of poverty and suffering. There exists likewise a moral sentiment in this community wide enough in its influence, and deep enough in its foundation, to afford the happiest auguries of the ultimate and entire success of those establishments devoted to the culture of the mechanic arts.

It has been truly observed, that there exists in this country 'a foolish disdain of bodily labor and dexterity.' This prejudice has done much to retard the progress of the useful arts among us, by leading the scientific either to devote their talents wholly to literary and professional pursuits, or to rest satisfied with simply exhibiting them theoretically. But when it is considered that a scientific knowledge of any art secures to an individual independence, by affording him a resort when other resources fail, and when in addition we remember the uncertainty attending the possession of property and the prosperous prosecution of commerce, we cannot but wonder that the arts, both useful and ornamental, do not more generally attract the labors of the scientific and enterprizing. 'If, therefore, it is important to the country that abstract principles should be applied to practical use, it is clear that it is also important that encouragement should be held out to the few who are capable of adding to the number of those truths on which such applications are founded.'(2) It is not to be supposed that the great number of young men who adopt professional pursuits, do so from any peculiar adaptation in their own powers and casts of mind for the particular profession they follow. It is evident, that in frequent instances the governing motives are far less judicious, and among these we may safely rank the leaning of public opinion towards literary pursuits. True, notwithstanding this, we can boast of those who have left enduring monuments in their inventions; but we may justly attribute the great encouragement given to the best and the noblest of American artisans to the early period in which he lived, and the great respect with which works of utility were then regarded.(3) Without doubt literary and professional pursuits have a high claim upon the encouragement and respect of our country, and happy it is that this claim has been recognized. Still, in the predominant encouragement which has been given to these employments, the great object has been to aid and develope talent—an object as noble as it is patriotic, and one which should not be forgotten with regard to scientific pursuits. 'It is for want of the little that human means must add to the wonderful capacity of improvement born in man, that by far the greatest part of the intellect innate in our race perishes undeveloped and unknown.'(4)

The principal reasons which have been assigned for the slow progress of the useful arts, are drawn from the wide separation which has been made between science and art, and the fact that many of the greatest inventions have resulted from accident rather than superior knowledge.(5) These considerations have tended to give to these pursuits the character of unintellectual employments. Whereas they require and call forth the best powers of the mind, and fail to secure the attention of the wise and talented only because they have been too much regarded as subjects of mere mechanical labor. 'Had Watt been an ignorant man, the model of a steam engine might have been placed in his hands, several times, for repair, without any discovery ensuing.' Scientific knowledge is absolutely essential to the progress of the mechanic arts.

The great object of study and mental effort, is the acquisition of original thought; and this we call invention, whether it is exhibited in the production of new ideas or practically set forth in a machine. Invention or the acquisition of originality, is the noblest effort of the human mind. It is thus, indeed, that the intellect manifests its native independence and energy, by leaving the beaten track, soaring to the conception of new truth, and adding another to the monuments of human talent and the means of human improvement. And it is when contemplating these results that we feel that the 'soul in all its higher actions, in original thought and in the creations of genius, has a character of infinity.' MARCELLUS.

NOTES.

(1) 'In the first ages of the world, when mechanism was not yet known, and human hands were the only instruments, the mind scarcely exhibited even the feeblest manifestations of its power. And the reason is obvious. As physical wants could only be supplied by the slow and tedious processes of hand work, every one's attention was thereby completely absorbed. By degrees, however, the first rudiments of mechanism made their appearance, and effected some simple abbreviations. One could now supply the wants of two, or each could supply his own in half the time previously required. And now it was that mind began to develope its energies and assert its empire over all other things.'

*Defence of Mechanical Philosophy.—N. A. Review, No.* 72, *p.* 125.

(2) Remarks on the decline of science in England, by Charles Babbage, Esq.

(3) This remark admits of qualification. Dr. Franklin undoubtedly owed much of the encouragement which was bestowed upon his mechanical inventions to the brilliant success which attended his philosophical researches. His character as a scientific man gave to his labors as an artisan a just reputation.

(4) In this connection it does not seem inappropriate to notice the amount of encouragement afforded by our patent law. The following sketch of its character and operation is derived from a few brief notes taken at the delivery of two lectures in March, 1831, before the Boston Mechanic's Institution, by Hon. William Sullivan.

Our patent law was derived from the English patent law, enacted in the reign of James I. 1633. The law is very defective, inasmuch as it does not recognize the right of property as the principle on which it allows patents; but rather as a favor conferred by the government upon the patentee. Whereas thoughts or the result of thoughts are as much property as the product of manual labor, and as such the proprietor has a just claim upon the government for protection. But the great defect which exists in the law is, that the inventor, when he obtains a patent, (for which he pays $30) is by no means secure in the undisturbed possession of his privilege. For he is continually liable, in case of an action, to

lose his patent through any trifling inadvertency in the phraseology of his specification, or upon the discovery that any part of his machine, however insignificant, was previously invented, unless he has specified it. It is not to be supposed that the means of ascertaining this important fact are accessible to every one, or even the majority of individuals.

The only expences of the patent office are for the room and the salary of one officer, which if deducted from the income, would probably leave $10,000. With this, and if necessary, an additional sum, Mr. Sullivan proposed that the government should maintain a board of commissioners, who should sit at Washington, and not only attend to the usual duty, but also give the patentee all the information and aid in their power. Mr. Sullivan also thought that in case of suits the patentee should not be liable to lose the whole of his privilege, but only a proportionate part, as in other cases.

When it is remembered that the patent law has for its specific object, the encouragement of native industry and talent, and the great influence it exerts upon the progress of the useful arts, the importance of the above suggestions must be apparent to every reasonable mind.

(5) The art of printing is said to have originated from suggestions awakened by the view of several impressions made by some figures cut from bark for the amusement of a child. A shower having moistened them, an impression was left upon the paper in which they were enveloped.

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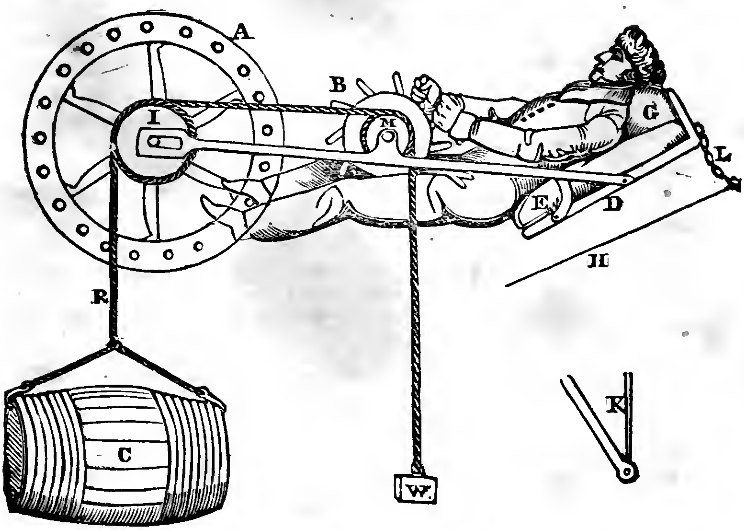


## PROPOSED APPLICATION OF HUMAN STRENGTH TO THE GREATEST POSSIBLE ADVANTAGE.

In the figure above sketched, is shown the whole strength of a man's legs, his arms, and the weight of his body, all concurring to raise the weight, c. Thus his legs, by means of his feet pressing against the rounds of the crane-wheel, A, exert a horizontal force in one given direction; his arms, in pulling at the handles of the lever wheel, B, a similar one, but in an opposite track; and that there is a concurrence of the weight in giving added effect to these motions, on the principle of a lever application, is manifest.

The rope, R, making one or two turns round the axle I, and the same at M, thence descends to W, which is a small weight hung on merely to detain the rope from sliding round the axle by straining it tight. In place of this arrangement, there may be substituted an endless chain, passing over the two wheels, A and B. D is a board, which, in conjunction with F, sustains the man in the inclined position he occupies, ultimately determining the pressure of his weight *in excess* against or upon the steps of the crane-wheel, F, being moveable on the axis at I. There is a pressure felt also upon his back and shoulders; to relieve him from the inconvenience attending which, the mattrass, E, and cushion, G, are provided, which also serve to hinder him, particularly the latter, from sliding upward, as he would otherwise have a tendency to do.

If at any time his arm become fatigued with the labor of *pulling* at the handles of the lever wheel, B, he can conveniently give them relief by changing their mode of action to that of *pushing*, as against a cross-bar placed between two supports [see fig. K] the doing which will give additional effectiveness to his weight, by depressing him lower down—a movement that will, of course, be determined to the crane wheel by an added impulse to turn it round; and on occasion of his being required to put forth a more than ordinary share of exertion, he may proceed in this manner. Setting his feet close together on the same step of the crane wheel, his legs kept straight and his knees firmly knit, he is then to press with all the force of his arms against the cross-bar, by which the utmost degree of power that human strength and weight combined are capable of exerting, will be brought into full and efficient action. A râtchet wheel and catch being provided to render secure the attainment of every such effect as he may thus be instrumental in producing, a fly wheel also might be added in connexion with the crane wheel, to aid the man in the exertion of his strength by upholding a uniformity of motion.

In conclusion, it need only be observed, that, to secure the individual at work from receiving any possible injury, the chain L, is set to the end of the board, and to a staple in the inclined floor, H, by which all tendency in the weight being raised to overpower that of the person and his strength included, is effectually guarded against; at the same time it is to be considered, that he has it always in his power to disengage himself, by only ceasing to place his feet on the steps of the crane wheel.

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## STRENGTH OF MUSCLES.

The animal frame constitutes an assemblage of levers. Its motions are performed by means of powers applied to these several levers, which powers are acted upon by means of nerves, which are influenced by means of the will; but by what manner this latter is performed we are entirely ignorant. For it is difficult for us to conceive how an *immaterial substance* can act upon matter; the fact, however, is indisputable.

A muscle is a bundle of flesh; or it is the flesh, in common language. The fleshy fibres compose the body of the muscle, and the tendinous fibres the extremities. Some muscles are long and round. Some have spiral, and some have straight fibres. Some are double, having a tendon running through the body from end to end. Some have two or more tendinous branches running through with various rows, and orders of fibres. All these, and several other orders of fibres are essentially requisite for the respective offices they are destined to perform in the animal system.

One design of the muscles is to give to the body that varied and beautiful form observable over all its surface, but their principal design is to serve the organs of motion. They are inserted by strong tendinous extremities into the different bones, and by their contraction and distention, give rise to all the movements of the body. The muscles, therefore, may be considered as so many cords attached to the bone, and in some cases, in order to multiply power, passing over pullies. The Author of nature has fixed them according to the most perfect principles of mechanics, so as to produce the fittest motions in parts the movements of which they are intended to effect.

One of the most wonderful properties of the muscles is the extraordinary force they exert, although they are composed of such slender threads or fibres. Philosophers and physiologists are not agreed with regard to the strength of muscles in different animals, especially in man. Some have made the force prodigious, while others have diminished it to that of a few pounds and even ounces. The truth may possibly lie between. I shall give a few instances of their calculations on the prodigious force in this communication, and may perhaps hereafter give other remarks. The calculation is amusing and interesting, and may direct the attention of the young mechanic to the subject of *animal statics*, as it is a subject intimately connected with Natural Philosophy.

When a man lifts up with his teeth a weight of 200 pounds by means of a rope fastened to the jaw teeth, the muscles named *Temporal* and *Masseter*, with which people chew, and which perform this work, exert a force of above 15,000 pounds weight ! If any one, hanging his arm directly downwards, lifts a weight of 20 pounds with the third or last joint of the thumb, the muscle which bends the thumb and bears that weight, exerts a force equal to 3000 pounds weight. When a man, standing upon his feet, leaps or springs upward to the height of two feet, if the weight of such a man be 150 pounds, the muscles employed in that action will exert a force 2000 times greater, that is, 300,000 pounds!

The heart at each pulsation or contraction, by which it protrudes the blood out of the arteries into the veins, exerts a force of above 100,000 pounds! The power with which the stomach digests its food, in conjunction with the assistance it receives from auxiliary muscles is, according to Borelli, equal to 261,186 pounds. There have been reckoned in the human body, about 446 muscles, which have been dissected and distinctly described, every one of which is essential to the performance of some one motion or other, which

contributes to our enjoyment: and in most instances a great number of them is required to perform their different functions at the same time. It has been calculated that about 100 muscles are employed every time we breathe. J. R. C.

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## INDIA RUBBER.

Messrs. Editors:—As the nature and application of Caoutchouc, (or India rubber) to different purposes, is but little known, I send you the following communication upon the subject, in hopes it may be useful to some of your readers. India rubber is the common name of this substance, but in chemistry it is called caoutchouc. It is the concrete juice of the *Hœvea Caoutchouc* and *Jathropa Elastica*, natives of South America; and of the *Ficus Indicus* and *Artocarpus Integrifolia*, which grow in the East Indies. It is procured by making an incision in the tree, from which it flows into a kind of bowl, made of clay, and attached to the tree when moist. From this, it is taken and formed into the desired shape with moulds, either by dipping them in or brushing them over with the gum while in its fluid state, which in a short time becomes a soft yielding solid, very tenacious, and remarkable for its elasticity. It is made into shoes, tubes and bags, for chemists, toys for children, and various articles both useful and amusing. As the nature of India rubber is such that it cannot be kept in a fluid state for exportation, and for this reason, cannot be applied to so many useful purposes, many experiments were tried to obviate this difficulty, which resulted in obtaining this great desideratum. This is done by the naptha* from coal tar, which will dissolve it without altering the properties of the gum. This solution can be conveniently used for making elastic tubes, but is more useful for covering cloth or leather, to make it impervious to the weather. This property of coal naptha was discovered by Mr. Syme. An easy method to make tubes, is to take sheet India rubber, about a tenth of an inch in thickness, an inch in width, and of any length, which must be cut with a pair of clean and sharp scissors, that the edges may be left with clean surfaces; then wind it spirally round a glass tube, bringing the cut edges in contact with each other, which is best done by applying a thumb nail upon each side of the section. When firmly pressed together while warm, the adhesion is such, that it will tear elsewhere as readily as at the junction. To prevent it from sticking to the glass, put a little flour over the inner surface of the gum, taking care that none of the flour gets upon the edges, which will prevent them from sticking. This process may be used with advantage in the repairing

* This substance is one of the products of the decomposition of coal. It is distilled from coal tar, at a very gentle heat, when naptha, from its great volatility, passes over and must be condensed in the mattrass. In distilling this substance, after the naptha has passed over another substance called napthaline, will condense in the neck of the retort, as a white, crystalline solid. This must not be used, but only the naptha in the mattrass, which is a dark oily liquid. Eds.

of India rubber shoes. In this case it is found to be useful to put a little of the gum, dissolved in spirits of turpentine, between the edges before joining them. It can be done, however, by merely using the clean edges and heat, as in making tubes. To make thin or sheet India rubber, I have heard of two methods; one is by gradually heating it until it becomes soft enough to be blown out as thin as wanted, the other, instead of heating it, is to soak it for ten or twelve hours in sulphuric ether, and blow it out in the same manner as when softened by heat. The common India rubber bags are generally used, as being the most convenient for this purpose. If this be done with ether, the bag, after being filled with air, should be left for the ether to evaporate, which will be in a few hours, when it will be found to have lost none of its elasticity. It may be observed, that in all experiments with Indian rubber, those parts which are to be kept separate should have flour between them; and in making the bags, it is necessary to blow flour upon the inside, to prevent their sticking. The following method I have used with success, in making small bags to be used instead of bladders, for philosophical purposes, (which are not easily kept from becoming dry and cracking.) Take a piece of sheet India rubber, double it, and cut the bag piece out with a pair of clean scissors, when the edges will be found to be slightly adhering to each other; then by taking a strip of the rubber, doubling it over the seam, and pinching it together with a pair of tongs or pliers, heated as hot as the rubber will bear without burning, (which should be tried upon another piece,) it will be found when cold to be as strong as any other part, and I have often burst the bag, by blowing in it, without starting the seam. The methods described in this communication I believe to be the most practicable and easy of those which are recommended: but if I should labor under any mistakes in this particular, I hope some of your readers will correct them, both for my satisfaction and the benefit of others. J. M. W.

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## SCIENTIFIC DEPENDENCE.

Slowly did even the art of printing progress, after the desideratum had become manifest. So imperceptible were its earliest improvements, that history has not been able to settle the claim of the first inventor. If Guttemburg was that man, he certainly did not perfect his discovery without the aid of Faust and others. Nor would Faust probably have originated it without Guttemburg. The discovery of gunpowder was accidental, and it was half a century before its use and application were understood. Nor had the first inventors any conception of its future uses. The great Bacon, the morning star of modern science, could not have appeared in a state of society fifty years earlier. Bacon was followed by Kepler, and Newton, and Locke, who, without the light which he and others had thrown upon the paths of knowledge, could never have appeared in the characters which they sustained. Nor should we ever have heard of Stuart's or Brown's philosophy

of the mind, if Locke, and Berkely, and Hartely, had not preceded them. Nor of Franklin, or Herschel, or La Place, but for those who had opened the way for their discoveries. And what would now be the state of modern chemistry, if Priestly, and Black, and Lavoisier, had never lived? Would Fulton have invented the steam boat, if Watt had not perfected the engine itself? Or who, without Arkwright, would have brought the improved methods of spinning cotton to their present state? Such is the structure of the human mind, and such its necessary dependence, one upon another, that man in a solitary state, or in one so rude as to be without the means of retaining past experience, or of handing the present down to others who are to follow him, can attain little more than to live upon the face of the earth, among its wild and wandering inhabitants. The whole history of the world, so far as we have it, proves the fact; and carries, upon its very face, the reason why so many generations of men have followed each other with so little advancement. They wanted the means of preserving and reciprocating their improvements, as well as the stimulus to make them.

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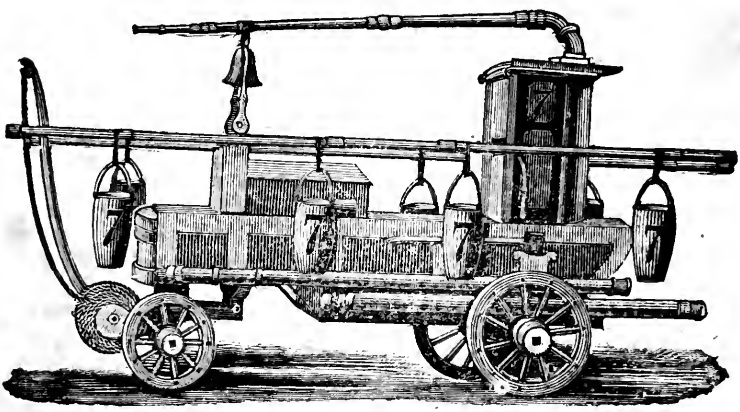


## FIRE ENGINES.

Fire engines were invented about the year 1663. A great number of different forms and arrangements of the working parts has been made, acting on the same general principles, the compression of air to produce a continued stream. The perspective view at the head of this article, is one of Mr. Newsham's fire engines ready for working. In this engine there are two cylinders connected with an air vessel by means of brass channels, generally known as the water ways; under each cylinder is a valve, as also at the end of the channel in the air vessel. The piston is made solid to fit tight in the cylinders, thus acting both as a sucking and forcing pump. The pistons are worked by iron chains, and receives their motions by means of two circular sectors

of iron, secured together and fixed upon proper squares of the middle horizontal bar. The shape of the piston rods, and the rise and situation of the chains that give them motion, are so arranged that the vertical axis of the piston is in the middle of the breadth of the perpendicular beam, part of the chains and the upper part of the piston rod taken together. The principles on which this engine acts to produce a continued stream are obvious. The water being driven into the air vessel by the alternate movement of the pistons, will compress the air contained in it, and proportionally increase its spring. The force of the air's spring will be always inversely as the space which it possesses. Were it not for this resistance of the air increasing in a greater ratio than the velocity of the water, by condensing a large quantity of air in a small space, the water could be forced to any given distance, but it is found that when projected with great velocity beyond a certain distance, the resistance of the air will disperse and separate the stream into small particles. The advantage gained by it is, that the reaction of the condensed air serves to keep up a constant pressure on the water in the air vessel, and sustains the stream perfect at the moment of the return stroke.

These engines are very convenient; the breaks or levers by which the engine is worked, being stationary, it is easily put in operation. The suction hose is at the end of the engine, so that it can easily be used on a wharf or the banks of rivers, in drawing and throwing the water. When these engines were first used, treadles on which men stood upon the engine were thought requisite, in connection with the breaks, as the moving power, but it has been found by experience that they are of no use, as sufficient power can be obtained by the breaks alone for all useful purposes. W.

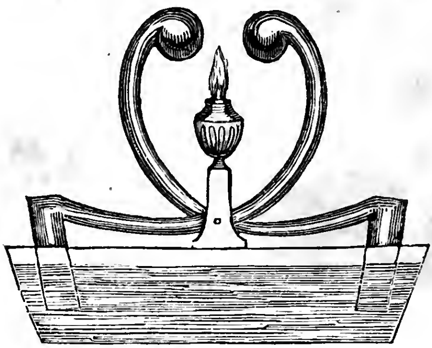
## NEW INVENTION.

Messrs. Editors—I send you the account of an invention, said to be new, with some remarks thereon.

There is a model of an ingenious engine at the Mansion House, by which a mill, or other machinery may be put in motion, by a new application of heat and cold. A beam is balanced, on each end of which is a copper vessel,communicating with each other by a tube; one of these rests over a fire which heats the water and rarifies the air, whose expansion forces the water through the tube to the vessel at the other end of the beam or lever, which is immediately brought down by its weight. The vessel, now raised beyond the influence of the fire, has its interior so nearly approaching a vacuum that the atmospheric air of the other vessel forces the water back to its former place, thus producing an alternate motion, which furnishes the power. A wheel is attached to the model, which is kept in motion by water which is returned into the reservoir, from whence it flowed, without waste. It is an ingenious invention, and from the simplicity of the machinery, if it succeeds on a large scale, must, in a great measure, supersede steam engines.

The inventor, Mr. Prouty, of Augusta, is on his way to Washington and New York, in order to deposit a model in the Patent Office, and to construct a machine of about thirty horse power.—*Savannah Georgian.*

That this invention is ingenious, I admit ; but that it is new, or useful (for the purpose stated above,) I think is not the case. The same principle has been applied before in various ways and for different purposes. Mr. Clegg has contrived a *Gas-metre* on precisely the same plan, and I have set several models to work of various forms on similar principles. The annexed figure is selected from among a number of drawings of such machines; some of them swing like a pendulum.



In this machine there are two copper balls, each having a tube open at the lower end, which terminates in a vessel of water. When one ball is placed over the lamp, some of the air which it contains is expelled, and escapes at the open end, and rises through the water. If the other ball be now brought over the lamp, the air will be rarified in that also, while a vacuum is forming in the first. At the same time the water rises in the tube above the level of the water in the vessel. This will now preponderate and bring the first ball over the lamp again ; the water will now be driven out of its tube by expanding the air, while the other tube is filling with water to be brought down in its turn, and so on alternately. This is the proper motion for working a pump, but the operation is too slow to be of any service; it will not do to heat and cool the balls at each stroke. In the American Mechanics Magazine there is a plan of an engine with a ball at each end of a beam; it has a separate steam boiler: the motion of the beam operates on the cock, to change the steam from one ball to the other. This I think is much better than Mr. Prouty's Machine or mine. HYDRO.

## METHOD TO OBTAIN WATER.

Messrs. Editors—The other day I called into the workshop of a young and ingenious mechanic of this city to inspect some of his inventions. Among his many contrivances I noticed one which might be useful to mechanics in general. His room being in the upper story, he was desirous to obtain water to supply his forge and for other purposes. With this view he inserted a leaden pipe in a proper manner into the spout of the building, and continued it downward through one of the upper panes of glass in the window to a hogshead in the room, which stood upon one end, the upper head being out. In the end of this pipe he fixed a common composition cock, the handle of which turned down horizontally, instead of vertically. In this handle he attached the end of a rod of iron about 15 inches long, which had on its other end a hollow sphere of tin or copper, made air tight, and which floated on the water. When it rains the water runs from the spout, through the pipe into the hogshead, and when it arrives at a certain height, the ball rising with the water closes the cock, and shuts it off from further entrance. His supply is at all times sufficient, and he is thus by this simple method saved a great deal of trouble and time.

OBSERVER.

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## SAFETY PIPE FOR STEAM BOILERS.

Mr. De Witt recently presented to the Albany Institute a plan to prevent the explosion of steam boilers. He recommends a pipe which is to extend from a few inches below the surface of the water in the boiler, to a height of two feet for every pound of pressure; that is, if the engine is working with 15 pounds to the square inch, the pipe must be 30 feet high. When the steam gets above this pressure the water will flow over the top of the pipe, and will also serve to give notice if the water is below the end of this pipe.

The same plan was pointed out in a letter to the editor of the London Times; the account is before me in a Boston paper dated May 19th, 1827, as follows; 'It appears to us far more efficacious than any we ever saw or hoped to see; the pressure of steam is measured by the rise of the water of the boiler in a pipe, inserted into the top of the boiler and immersed in the water, in the same manner as the mercury in the barometer gives the pressure of the atmosphere.' It goes on to state that the pipe must be two feet high for every pound of pressure, and concludes with nearly the same observations as above. This plan certainly deserves a fair trial. I would observe that the height stated is not enough. It requires nearly 28 inches of fresh water to support one pound of pressure. The precise height may be found by multiplying the pressure by 2·304. If the pressure be 15 pounds the height will be 34·56 feet.

WATT.

## MECHANICS' INSTITUTION.

In one of the cities of the British empire, a mechanics' institution was established, a few years ago, when Brougham and Birkbeck, and many enlightened and liberal men, were suggesting and stimulating the popular instruction of the working classes. To this institution a talented and efficient lecturer was procured, whose engaging and attractive manner soon gained him a high reputation. It was a delightful scene to walk in, on a winter's evening, and see such a crowd of young men, and among them many of the middle aged and old, who, instead of spending their leisure time in the roar and dissipation of a tap-room, were listening with breathless attention to the reasonings of the lecturer, and viewing his experiments with lynx-eyed curiosity. Many of them belonged to trades which could easily furnish them with an excuse for non-attendance, on the score of fatigue and want of cleanliness. But these very classes seemed to be among the most indefatigable of the audience. No storm could frighten, no distance detain—there they were, with clean washed faces, and aprons neatly tucked up, and almost every one with a book for the purpose of exchanging at the library. The benevolent mind, in viewing such a scene would naturally spring forward to the hour, when the wilds of America, the deserts of Africa, and the lone isles of the Pacific, would boast their Broughams and their mechanic institutes—and every shade of humanity, from the blooming white and red, to the deep glossy black, know no distinction but *mind*—no superiority but *intellect.—Dublin pap.*

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## MODE OF PRESERVING BEER FROM SOURING.

A copper ball, of about five inches in diameter, strong enough to bear a considerable pressure, has a cock attached, with a wood screw cut on it, which screws into the hole in the top of the cask, into which the vent-peg is usually put. Previous to attaching this ball to the cask, carbonic acid is injected into it to a pressure of about 50 pounds to the inch (this is easily done by means of a condenser of small bore:) it is then to be screwed to the cask. When beer is to be drawn, the cock in the bottom of the cask is opened, and when the beer ceases to run from it the other cock is opened, communicating with the ball, and the carbonic acid gas allowed to press upon the liquid in the cask, which acts much more forcibly than by permitting the atmospheric air to rush in, as has been usually done. The chief advantages to be gained by Mr. Mallett's contrivance, are, first, the perfect exclusion of the external air; secondly, portability; and thirdly, the convenience of being able to apply a considerable pressure to impregnate the beer with the gas, as in the manufacture of soda-water.

The whole apparatus may be constructed for the same sum as is usually paid for the patent vent-pegs; and if it did cost something additional, it would be fully repaid in the beer keeping so much longer.—*London Mech. Mag.*

## ANSWERS.

Messrs. Editors—I was pleased to observe in your last number a question relating to a more humane method for killing neat cattle, than the one in common practice. In many places in other countries,* and I know not but in some parts of this, a much more humane method is employed. It is as follows: At that part of the skull of the animal that joins his neck, there is a circular hole, through which the spinal marrow issues from the brain, passing down into the back bone. Extensive injury to the spinal marrow at this spot, where it leaves the skull, is instant death. Now if a pointed instrument, having a broad blade, be laid flat against the base or back of the skull, the point of course directed downwards, it may, by a blow from a mallet, or a vigorous thrust, completely sever the spinal marrow at the point above indicated, and the animal will die instantly.

Let a butcher examine this hole in the base of an ox skull that may be laying about. Remember that the knife must pass between the wall of the skull and the first bone of the neck, (and therefore the wall of the skull will guide the knife ;) let him try his skill first a few times on a dead animal, so as to learn the direction, the degree of force necessary, &c. and he will find it a much more convenient practice than the barbarous one so generally used at present.

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Messrs. Editors—Information is required by Philo, in your last number, for the cause why horses were killed by lightning, while the persons in the carriages drawn by them remained unhurt. I should attribute their death to the conducting power of the steam or vapor, by which their bodies are surrounded during their extraordinary labor in the heat of summer. Vapor is a good conductor of electricity, and it ascends considerable distance above the animal producing it. Animal bodies, although good conductors of electricity, are much effected, and if in sufficient quantity, it causes their death.

A PRACTICAL ELECTRICIAN.

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Messrs. Editors—In answer to the question in the last number of your useful Magazine, relating to the seamen's frugal meal, I would say, that the 6 cents which D paid should be divided among A, B and C in proportion to the number of biscuits each had. The whole number of biscuits being 12, and A having had 3 of them should have 3-12ths of 6 cents, B 4-12ths, and C 5-12ths; consequently A's share will be 1 1-2, B's 2, and C's 2 1-2 cents.

T.

If the three men had furnished goods for sale as in a mercantile adventure, the answer of T. would have been right. But as we understand the question, the answer of M. is correct.

EDS.

Messrs. Editors—The question, how should the money be divided between the 3 seamen, A, B and C, I would answer in this way:—B should receive 2 and C 4 cents. The reason of this decision is, the whole number of biscuits is 12, which divided equally between the 4 seamen would allow 3 to each. As A had but 3, he only had his share, while B had 1 and C 2 to spare, which made the share of D. Thus it will be seen that as A gave nothing he could receive nothing, and the money must be divided between B and C, B to receive one-third and C two-thirds.

M.

* This practice prevails in Portugal. Lord Somerville caused a person to be instructed in the art.—See *Dom. Enc.* vol. 3, p. 252. EDS.

## QUESTIONS.

Messrs. Editors—A friend informed me the other day that air has been condensed into the ball of an air gun, so that its weight was increased one ounce and a half by the operation.

*Query.* What pressure on the square inch did the ball sustain, supposing its internal diameter to be four inches, the weight of a cubic foot of air one ounce and two-tenths, and the pressure of the atmosphere fifteen pounds on the square inch? ANVIL.

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Suppose a column of water be discharged through a gate with a velocity of 16 feet per second, and that that velocity be diminished one half by the resistance of the water wheel, what part of the power is expended, and what part remains in the water unexpended? F.

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A person bought a certain number of calves for 80 dollars, and if he had bought 4 more for the same sum, they would have cost a dollar a piece less. Required the number of calves, price of each, and mode of solution.

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Messrs. Editors—Permit me through the medium of the Young Mechanic, to inquire of the many masons or brick layers of our city, why they do not contrive some more elegant method to prevent chimneys from smoking, than those unsightly piles of bricks which are so generally added to their tops. G. R.

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How many different ways can the twenty-six letters of the alphabet be placed, using the whole each time? ☞

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## TO CORRESPONDENTS.

The abstract of the proceedings of the late meeting of the New England Association of Farmers, Mechanics and other Workingmen, promised in our last, is deferred in order to notice the auxiliary to said Association now forming in this city, at the same time.

'Table of the Velocity for Boring and Turning Cast Iron,' 'Railways and Carriages,' 'Theory and Practice,' a Question respecting the Atmosphere, and an article on the Apprentice Question, are received.

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Erratum.—In the last number, 23d page, and 14th line from the top, for '*inch* point,' read, '*ink* point.'

THE

# YOUNG MECHANIC.

VOL. I. APRIL, 1832. No. IV.

## OBSERVATIONS ON DRAWING INSTRUMENTS.

[Continued from page 34]

### THE DRAWING PEN.

THE drawing pen is an instrument used only for drawing straight or slightly curved lines. They are made in many different forms, but they all consist of two blades of steel fixed to a handle, which being bent, have a tendency to spring open from each other, and to allow the points to be brought very near together. They have a screw or equivalent contrivance passing through both lips by which the points may be closed together to any required degree, as the line is to be drawn stronger or finer. The ink being put into the small opening between the points, about a drop is retained, which flows down as occasion requires. The pen should be fed with ink, by a camel's-hair pencil, which comes to a very fine point so as to pass freely through it. In using the pen, it must be fairly applied to the edge of the ruler, the breadth of the intended line being regulated by a screw, and drawn along it, taking care to hold it so that both points touch the paper at once, or it will not draw an even but a ragged line. It will act best if it is held a little inclined in the direction of its motion; it then leaves fairly upon the paper a breadth of ink equal to the opening between the points.

The points of the pen should be rather round, that they may not penetrate the paper, and that they may move easily over it, which would not be the case if they were too fine; but in thickness they should be quite sharp at the edge—otherwise they will not make a regular and a fine line. A great deal depends on the quality of the paper upon which we are to work. If what is called the cartridge is used, it is best to have the points rather blunt, as they do not wear so fast. The best kind of pens consist of two long blades of steel, held together in the centre by a rivet, upon which they turn, and secured at the top by a brass cap which has a female screw cut in it, to fit on the extremities of both blades, which being laid together have a screw formed on them. The lower parts of the blades have a milled screw for adjusting the distance between

them. When it requires sharpening, the lower screw is taken out, and the brass cap unscrewed. The blades may then be opened like a pair of scissors. The points of all pens should be made of the best hardened and tempered steel, as by constant use they frequently grow blunt at the edges, and must then be repaired by rubbing them upon a hone to sharpen the edges again. In doing this, great care is necessary to make both points correspond in length and breadth, and will require a great deal of practice to enable the student to do this with correctness. The best mode is to wear a groove in the stone by constantly rubbing the pen in the same place. This gives both lips the same breadth and contour, but still they may not be of the same length. To remedy this, pens have been invented, so that both blades, by turning a screw or otherwise, might be accurately adjusted to the same length. The cuts below will serve to illustrate a pen of this description.

Fig. 1

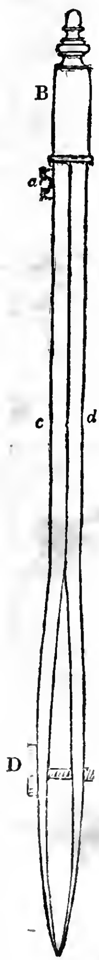


Fig. 2.

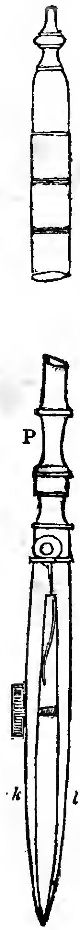


Fig. 3.

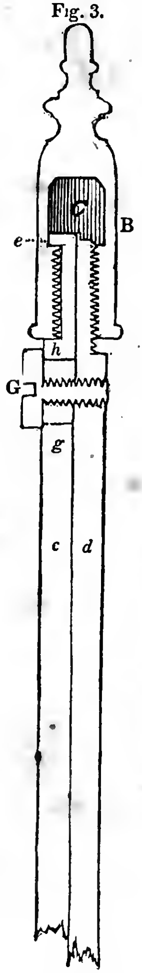


Fig. 4.

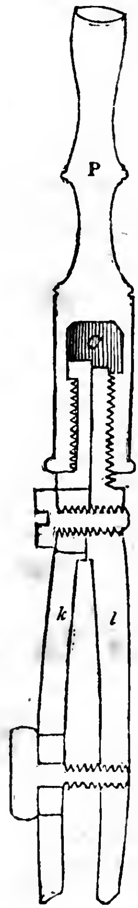

Fig. 1 (with the exception of the dotted screw head *a*) and Fig. 2, represent the two kinds of drawing pens most in use. The improvements which are to be applied to each, are shown in Figs. 3 and 4. As Fig. 1 is *now* constructed, a screw is cut on the end of the lips *c* and *d*, on which is screwed the brass cap B. In Fig. 3 it will be perceived that a chamber C is cut, the radius of which is larger than the interior radius of the screw, by the projection *e* on the lip *c*. The screw on the lip *c* is to be filed off down to its interior radius, and the projection *e* made on the end The screw is left on the lip *d*. G is a screw for clamping the two lips; and a space *gh* is made in the lip *c*, of sufficient length to allow the 'play' of the screw G, occasioned by the movement of the lip *d*. A similar space should be cut at D, Fig. 1. It will now be evident that when the screw G is loosened, and the brass cap B is turned, the lip *d* will recede or advance, so that we can at any time perfectly adjust the lips *c* and *d* to the same length, and when the screw G is tightened, there can be no possibility of turning the cap B by handling the pen, or by accidentally dropping it, or otherwise. In Fig. 4, *k* and *l* are lips similar to *k* and *l* in Fig. 2. The remaining parts need no description, as they are exactly like Fig. 3.

The same observations in regard to sharpening will apply to pens which are to be inserted in the compass leg, only it must be observed that when an arc of a circle is to be described of more than an inch radius the ink point should be bent in the joint so as to stand perpendicular to the paper; otherwise the line will not be smooth. The common pens are formed with a joint to unite the two blades together, having a small spring between them to force them open, and an adjustiug screw for closing. It is necessary that the blades should be wiped very clean before the pen is put away; otherwise they will rust and spoil. Here let me caution the student against using common ink in his pen. The vinegar it contains acts very powerfully on the points, and is apt to corrode them so much that the pen will soon be rendered unfit for use. The top part of the pen contains a small protracting pin, which is used to mark the intersections of the lines, and to lay off distances from the edge of the plotting scales. A very useful little instrument of this kind may be made by inserting a common needle into a small handle. It is well to be provided with three or four of these, as they are very handy at times to steady a ruler in drawing long lines. The steel pen being as perfect as can be wished, for drawing straight or regularly curved lines (when some guide is used for it) will not do for those lines which are to be drawn by hand unassisted by a ruler, or other means of directing it. It is the usual practice to draw such lines with the small crow or common goose quill. But they can be much more neatly executed by various steel writing pens which have appeared. A very good kind is made by Donkin of London. The nip or point consists of two pieces of thin steel plate, put together nearly at right angles to each other, the part where they meet being bevelled or mitred, to make a joint for the slit of the pen, which is quite close except when the pen is writing. The pressure which is then used bends the nips, and causes them to de-

liver the ink very freely, and so in proportion as the pressure is increased the line becomes broader, as in the common goose quill, but having the advantage of being more elastic in the blades of the nip, which are filed very thin just above the point. Many prefer this form to the round pen, the latter not being able to spring so readily, on account of its being a portion of a tube, however elastic its substance may be. This difficulty is in a great measure obviated in the Patent Perryian Pen, which has been but lately introduced into America. The patentee, by a triangular form which he gives the slit above the points, makes both nips extremely elastic, and his pens are formed on a principle which is decidedly the best in use. In sharpening all these kinds of pens, the back should in the first place be inclined to the hone at an angle of 75 or 80 degrees, moving it backwards and forwards very lightly and steadily to make both points of the same length. After this is done the pen should be turned and both points brought to the same breadth. At first it will not probably write so well as it will after being used a little time, the points being sharp and apt to catch in and tear up the surface of the paper; it is therefore best at first to use it for a while on a piece of rather coarse paper.

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In future we shall publish a list of Patents granted to inventors residing in Massachusetts, and the most important ones in other States, which we shall extract from those works in which all the new patents issued are recorded.

## PATENTS FOR MASSACHUSETTS,

GRANTED JANUARY, FEBRUARY, MARCH, APRIL, MAY, AND JUNE, 1831.

*January.*

1. For a mode of *saving water in water power.* Aaron Foot, Williamstown, Berkshire County, Jan. 4.

2. For a *furnace* for generating steam for *culinary purposes.* Jesse Reed, Marshfield, Plymouth County, Jan. 5.

3. For an improvement in Frames for cotton Gins. Ebenezer A. Lester, Boston, Jan. 8.

4. For an improved mode of making Harrows for the purpose of Agriculture, called the 'Revolving Harrow.' Samuel Rugg, Lancaster, Worcester County, Jan. 11.

*February.*

5. For an improvement in the mode of *Pressing Cheese,* by a 'Screw and eccentric wheel cheese Press.' John C. Pulsifer, and Ebenezer Pulsifer, Ipswich, Essex County, Feb. 14.

6. For an improvement in the *manufacture of buttons,* called 'Metallic shank buttons.' Josiah Hayden, Williamsburg Hampshire County, Feb. 17.

7. For an improvement in the steam boat paddle wheel. Timothy Hunt, Boston, Feb. 17.

8. For a machine for pointing pegs for boots and shoes. William A. Greenwood, Palmer, Hampden County, Feb. 19.

9. For a machine for moving earth, stones, &c. Shadrach Davis, Dartmouth, Bristol County, Feb. 22.

10. For an improvement in *mortise door fastenings.* Leonard Foster, Boston, Feb. 25.

*March.*

11. *For making axes by machinery;* being an improvement upon the apparatus called the 'oval axe machine.' Stephen Hyde, Williamsburg, Hampshire County, March 2.

12. For an improved *block* for *stereotype plates.* Bradbury Hackett, Boston, March 8.

13. For an improvement in gas metres. H. Robinson, Boston, March 10.

14. For a machine for *grinding apples.* Silas Freeman Jr. New Marlborough, Berkshire County, March 14.

15. For an improvement in the construction of *lamps.* John W. Shulze and Tod Trull, Medford, Middlesex County, March 19.

16. For a machine for *splitting, shaving and cutting leather, skins, &c.* Augustus S. Dawley, Boston, March 22.

17. For an improvement in the construction of *steam boats,* for the passage of rapids. Thomas Blanchard, Springfield, Hampden County, March 28.

18. For an improvement in the mode of *mixing paints.* Jonathan Linnel Jr. Orleans, Barnstable County, March 26.

*April.*

19. For an improvement in the *method of washing rags* in the manufacture of paper. John Ames, Springfield, Hampden County, April 6.

20. For manufacturing spades and shovels by means of machinery. Charles Richmond and Samuel Caswell Jr., Taunton, Bristol County, April 7.

21. For a machine for making horse shoes. Dana Anthony, Jr., Adams, Berkshire County, April 8.

22. For an apparatus for communicating power to machinery. Samuel Kilburn, Sterling, Worcester County, April 16.

23. For an improvement in couches, sofas, settees and chairs, called the 'windlass couch, sofas,' &c. Charles Adams, Boston, April 18.

24. For a *polishing and graining machine,* for Morocco and other leather. Robert Emes, Boston, April 20.

25. For a *new material for sheaves of blocks.* Caleb Curtis and Thomas C. Smith, Boston, April 20.

26. For an improvement in the *horizontal square piano forte.* Ebenezer R. Currier, Boston, April 22.

27. For an improvement in the machine for *splitting leather.* Alpha Richardson, Boston, April 23.

28. For an improvement in the process of dressing woollen cloths, and cloths composed partly of wool and partly of cotton. Calvin W. Cook, Lowell, Middlesex County, April 23.

29. For an improvement upon a water wheel for propelling boats, for which a patent was obtained on the 22d of December, 1818. Asa Waters, Millbury, Worcester County, April 30.

*May.*

30. For improvements in a machine formerly patented by Amos Whittemore, for *cutting the teeth*, *pricking the holes*, and setting the teeth in filleting cards. Reuben Meriam, Leicester, Worcester County, May 2.

*June.*

31. For a machine called a ‘Self balanced handcart.’ George Coolidge, Watertown, Middlesex County, June 13.

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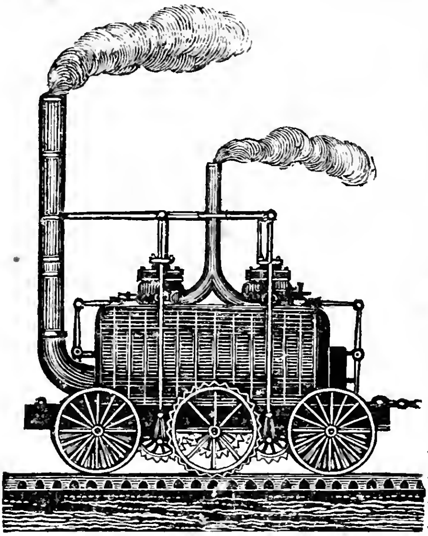
## RAILWAYS AND CARRIAGES.

It is rather uncertain at what precise period railways first originated. They probably arose from the circumstances of laying down timbers or planks over the obstructions which were presented at the collieries, for the wheels of their rude carriages to roll upon. Afterwards it appears these timbers were laid more systematically and in considerable lengths, and have gradually given place to the many improvements which have been made in this system of travelling that is before us at the present day. In comparing railways with canals, it is evident that each mode has its peculiar difficulties and advantages. Where the first might be built, the second could not. Experience proves that for heavy goods railways are not so well adapted as canals, but for speed of conveyance of lighter articles and passengers, they surpass them. All the railroads that are being built, or are about to be built in Massachusetts, will chiefly derive their income from the transportation of passengers. We have yet a great deal to learn in regard to railways. It is feared by many that the great ‘hue and cry’ that has been raised within a few years concerning them, will be an ‘idle wind which blows nobody any good.’ Others who profess to know more of the subject, predict they will be the ‘roads to wealth,’ to our citizens and states. Each system has its supporters; but it must be left to time to show which will be the most beneficial. All the railways that have as yet been constructed in America have been closed during the winter, and generally long before the canals, and not re-opened until the latter have been travelled on some weeks.

We shall ere long rival England in our locomotions, as we have excelled her in our steam boats. Why will our mechanics allow the different railway companies to import their carriages? Is there not ingenuity enough in New England, to improve on the Rocket and Novelty? It requires but the attention of some of our steam engineers to the subject, to produce an engine which shall excel in all its parts the far famed engines of the Liverpool and Manchester road. As yet there has been but few successful attempts at constructing steam carriages in this country; one, the Cooper locomotive, is now running on the Baltimore and Ohio railroad, and thus far has performed very well. Lately there appears to have been some considerable notice taken of Mr. Sargent's single railway, but it is not probable that it will ever come into general use. This kind of railway was invented and patented

in England, by Mr. Palmer, who has applied it successfully to the gates of the London docks. The cogged railway of Blenkinsop, (of which the cut below is a representation,) seems to be entirely



exploded for other than short distances or inclined planes. A great velocity of the engines on this principle is attended with very destructive consequences. 'The boiler is supported by a carriage with four wheels without teeth, and rests immediately upon the axles. The engine is a high pressure one, and has two working cylinders. The connecting rods give motion to two pinions by cranks at right angles to each other, and these pinions communicate the motion to the wheels, which work into the teeth of the railway by working into a toothed wheel on the same axis. An engine of this kind when connected to a train of 30 coal waggons, each weighing more than 3 tons, moved at the rate of about 3¼ miles an hour.' We are yet in our infancy in regard to railways. It is evident that we cannot follow the English roads exactly as models to build ours from, but must adapt them to our climate, and the different kinds of trade. We shall probably have to raise them much higher from the surface of the ground than is done in England, that the snow and ice may not collect in them, and impede the transportation. We have erred greatly heretofore in our canals in not building them wide enough. Experience has proved that a horse can draw a boat carrying 60 tons almost as easy as one of 20. Our locks have been built much too narrow. By recent experiments on the Paisley and Anderson canal, in Scotland, a boat was impelled at the rate of 12 miles an hour with ease, without injury to the banks, this being one of the narrowest canals in Scotland. The boat after having attained a certain speed is raised and floats, as the boatmen term it, on the 'top of the wave' in front, and does not surge the banks. If the banks were walled up with stone, for one or two feet below the surface of the water, and the canal formed 60 feet wide, and 8 or 10 feet deep, with locks 100 feet long and 20 feet wide, a boat might be impelled with a velocity of double what is done at present, and boats of 60 or 80 tons moved with the same expense. This, no doubt, will be effected in all the canals which may be built in future, and will place them once more on a footing to compete with railways, after all which the sanguine projectors have said and written concerning them. FULTON.

## TABLE
### *Of the Velocity of Boring and Turning Cast Iron.*

| | BORING. | TURNING. |
|---|---|---|
| *Inches Diameter.* | *Revolutions of bar per minute.* | *Revolutions of shaft per minute.* |
| 1 | 25· | 50· |
| 2 | 12·5 | 25· |
| 3 | 8·33 | 16·67 |
| 4 | 6·25 | 12·50 |
| 5 | 5· | 10· |
| 6 | 4·16 | 8·32 |
| 7 | 3·57 | 7·15 |
| 8 | 3·125 | 6·25 |
| 9 | 2·77 | 5·55 |
| 10 | 2·5 | 5· |
| 15 | 1·66 | 3·33 |
| 20 | 1·25 | 2·50 |
| 25 | 1· | 2· |
| 30 | 0·833 | 1·667 |
| 35 | 0·714 | 1·430 |
| 40 | 0·625 | 1·250 |
| 45 | 0·56 | 1·12 |
| 50 | 0·5 | 1· |
| 60 | 0·417 | 0·834 |
| 70 | 0·358 | 0·716 |
| 80 | 0·313 | 0·626 |
| 90 | 0·278 | 0·556 |
| 100 | 0·25 | 0·50 |

For boring cast iron the proper velocity for the *surface bored* has been found to be 78·54 feet per minute. A greater velocity than this not only takes out the temper of the cutters by producing great heat, but also causes the metal to expand, when if the machine stops for a short time a mark is left from the contraction of the metal. If hand tools are employed in turning, the velocity may be considerably increased. The progression of the cutters may be one-sixteenth of an inch for the first cut, and for the last one twenty-fourth.

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Cement for rendering Joints Steam Tight. The following receipt forms a strong and durable cement for joining the flanches of iron cylinders of steam engines or hydraulic machines:—Mix boiled linseed oil, litharge, red and white lead together to a proper consistence, always using the larger proportion of white lead. This composition may be applied to a piece of flannel and fitted to the joint. Cisterns built of large square stones and put together with this cement will never leak.

A more powerful cement for withstanding the action of steam is composed in the proportions of two ounces of sal ammoniac, and four ounces of sulphur, made into a stiff paste with a little water.

When the cement is wanted for use, dissolve a portion of the paste in water rendered slightly acid, and add a quantity of iron turnings or filings, sifted or pounded to render the particles of uniform size. This mixture, put into the interstices of iron work, will in a short time become as hard as stone.

NOTE.—From experience it is ascertained, that more depends upon caukling the joints than in mixing the cement. EDS.

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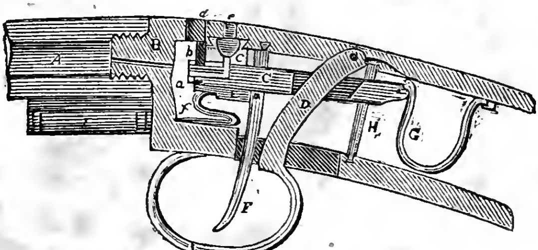


## MAGAZINE GUN LOCK.

THIS lock was invented and made by George W. Morse, (when about eighteen years of age,) son of Rev. Bryan Morse, of Haverhill, N. H. An account of it appeared in a Portsmouth paper some time ago.

A is a portion of the breech of the barrel; B is the breech-pin which makes the outer boundary of the lock. The guard is divided into two parts. The anterior half serves only to complete the form of a common guard, and is immoveable. The other half D, acts as a lever, and is attached to the upper part of the breech-pin, and passes through a mortise in the hammer, C. By drawing back this half of the guard, the hammer is drawn with it, and by this motion the gun is cocked.

There is a small spring fixed in the upper part of the breech-pin, which throws back the moveable half of the guard after the hammer is fixed for firing, so that the guard then appears to be entire. The hammer, C, consists of a straight bar of steel, two inches long and one-fourth of an inch square, through which is a mortise as above mentioned, for the moveable half of the guard to play in. The hammer is thrown forward by the spring, G. It moves in a straight line, and strikes against the centre of the barrel. The trigger, EF, is secured to a pillar which is placed between the prongs of the breach-pin, and which also supports the hammer. A small spring *f*, presses the arm E of the trigger against the end of the hammer, which keeps the gun cocked. In the operation of cocking the gun, the nipple *a*, which slides into the end of the hammer, is drawn forward by the fixed stop *b;* or rather, it is stopped before the hammer is drawn entirely back. A space is thus made in the hammer directly under the magazine *c*, and the priming falls into this space or cavity. The nipple is one-fourth of an inch

long, and one-twelfth of an inch in diameter, with a cap large enough to cover the head of the hammer, and has a perforation in it large enough to admit a common pin. This hole makes a communication between the space in the hammer, (which receives the priming from the magazine above,) and the charge in the gun. When the hammer is driven forward in the act of firing, the nipple strikes against the barrel, and is forced back into the hammer where the firing is effected by percussion. The magazine contains powder for sixty primings, and is so contrived that neither water nor dampness can penetrate it. The priming powder is put in at *e*. The hole at *d* is for a vent. H is a guide for the hammer, and I the pipe for the ramrod.

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## THOMAS KEYES, JR.

It is a pleasing task, to follow through all the mazes, and to dwell upon the incidents connected with the rise of an ingenious man, however he may have been favored by circumstances, or assisted by fortune. If we dwell with pleasure upon the character of such a man, with what sensations must we trace the rise and progress of that man, who, imitating the course pursued by Franklin, Ferguson and Simpson, rises from obscurity by his own efforts, without the advantages of education, the assistance of fortune, or the advice of friends, and beats out a path which those in better circumstances would scarcely attempt to follow. That the life of a mechanic, distinguished for his perseverance and application, and with all, a native of our own states, will be interesting, (at least to mechanics,) I will not qnestion. It indeed must be a source of interest to any one, to see an individual of their own class in society, in circumstances inferior to themselves and with less means for improvement, struggling to overcome the difficulties and disadvantages with which he is surrounded; endeavoring, by every means in his power, (without injury to others) to better his condition, either in fortune, or acquirements. Such an individual, should surely be the object of universal esteem. It has been justly remarked, that although the disadvantages are great, of those who are obliged to begin their acquaintance with science late in life, yet all the chances of the race are not against them. The time they have lost, and are anxious to redeem, of itself gives a stimulus that will make up for many disadvantages.

Such was the case with the subject of this sketch, who was born at West Boylston, Mass. His time appeared of so much importance to him, that he often denied himself the necessary time for sleep. As he did not apply himself to a mechanical business until he was 20 years of age, he considered it a duty to redeem it if possible. The cause which prevented him until this age from following his favorite pursuit, was neither poverty nor inclination, but the wishes of his friends, who, 'not seeing as he saw,' endeavored to check what they considered his wayward fancies, and to fix his mind upon the cultivation of the farm, of which

he was to become a part possessor. Although he appeared to yield to the wishes of his friends, yet he never could bring his mind to acquiesce in the idea of spending his life in a pursuit so contrary to his inclinations. While with his hands he cultivated the soil, his mind was panting for that knowledge which he knew as a mechanic he could practice. And, the time which was not occupied in labor on the farm, he spent in the cultivation of his mind. Although he devoted himself to mathematics, natural philosophy and astronomy, yet his taste for music appears first to have shown itself; and the ingenuity displayed in his first attempt to gratify himself is worthy of notice, and is thus described by a friend: 'the first known of his musical performances was upon an instrument of his own manufacture while he was very young; it was made of a shingle, with silk strings strained across in the manner of a violin, a small stick from an apple tree, and some hair from a horse's tail served for a bow; and upon this rude instrument, the young performer has produced music which has been listened to with considerable pleasure.' From this rude but successful attempt may probably be traced the first desire he had to make himself master of the art, in which he afterwards became very proficient as a performer upon several instruments. Some time previous to his leaving the farm, his attention was attracted by a description of an organ in a cyclopedia to which he had access, and from the accurate account of the different parts there given, he formed the idea of making one himself, the parts of which were to be of wood. This was considerable of an undertaking to one situated as he was, without tools, or materials, and many would probably have abandoned the scheme as impracticable; but his perseverance led him to devise means to obviate these difficulties, and by the friendly assistance of a cabinet maker who allowed him the use of his tools, he was enabled to accomplish his object to his perfect satisfaction.

But, with all the fascination and pleasure which naturally follows the study of music, it was made to give way to the more solid sciences. Of these, mathematics, (which is considered by some, as the most dry and insipid of all studies,) held the first place in his esteem. It was considered by him in its true light—as the only foundation on which the other sciences could be firmly built. He thought no time mispent, while engaged in solving the intricate and abstruse problems with which it abounds; and I have often heard him observe, that 'mechanics were not aware of the disadvantage of attending so little to this all-important science.' It must certainly be confessed, that it has been very much neglected by this class of the community; for if we look around, and see how many have been ruined by schemes, which, with a little attention to the truths explained in this science, they might have avoided, we cannot fail of being impressed with the necessity of urging it upon the candid consideration of mechanics. Let it but be realized, that this is the key stone, by which the grand arch of science is secured, and on which the hopes of genius must be based, then will those difficulties which appear insurmountable, vanish—the abstrùse will be simple, the useless important, and the tedious pleasing.

In the study of astronomy, which had engaged his attention during the latter part of his life, he found his knowledge of mathematics of the greatest service, in making the numerous calculations which were necessary in the construction of apparatus, by the aid of which correct ideas could be conveyed to the minds of the youthful, and uninformed, of this sublime and interesting science. An Orrery, which he contrived for the purpose of illustrating the relative motions of the solar system, is very simple and economical, and, when united with its correct calculations and ease of management, forms one of the most useful instruments of the kind. To be used in connection with his Orrery, he had in view an apparatus which was to embrace the Lunarium and Tellurium on a plan different from any at present known. But unfortunately the traces of the design which he has left are so obscure, that it is impossible for any one to understand his views sufficiently to complete it. A piece of board which he had prepared for the purpose of making a working draft of his plans, was not used, in consequence of his being taken ill with that disease, from which he never recovered.

In addition to the studies which have been mentioned, he likewise pursued that of drawing and painting; the latter, however, occupied but a small share of his time. To his taste for painting, may be attributed an apparatus he contrived, a description of which, may not be uninteresting; an experiment in optics, which is no doubt familiar to many, and is performed by having a piece of circular board painted in equal proportions of blue, yellow, and red, and made to revolve with great velocity. The board will appear while whirling of a dirty white. If the board were divided into twelve parts instead of three, and should have four series of the colors, blue, yellow and red, one-fourth of the velocity would produce the same effect. The 'cameleoscope' is the name of the machine contrived by Mr. Keyes, so called from the various changes of color produced by it while in motion. It is made by cutting out nine of the twelve parts of the board, and leaving but one series of colors equally divided. Then by making four such boards painted with various colors, revolve behind each other with different velocities, it will exhibit a continual change of color; and if by any means it could be stopped, when a pleasing shade presented itself, it might be known what colors had produced it. This was a scheme, which is probably more curious than useful. But although it might not have been of any practical utility, yet it might have contained hints which may hereafter be applied with advantage.

We may here regard a trait in the character of Mr. Keyes which is worthy of all imitation, that of communicating information to others freely, and especially those discoveries which we have made, and do not know to what purpose to apply them. A free communication of sentiment and opinion between different persons, is acknowledged to be of the greatest benefit. The institution of Lyceums, and other societies, is but to assist in accomplishing this end. Mr. Keyes was fully aware of the advantage resulting from persons associating together for mutual instruction; and acknow'

edged that he had been greatly assisted in the study of astronomy by being a member of a small society of individuals in his native village, who met together for mutual improvement in that science. At the head of this social club, was the venerable and respected astronomer and philosopher, Robert B. Thomas. To this gentleman Mr. Keyes looked up with reverence; his kindness in furnishing books, and assisting him in his various studies, were favors which were never forgotten.

Let it not be urged, that a person who turns his attention to many things can do nothing well; for, although it may be true in some degree, yet it is not without exceptions. Sir William Jones, the greatest civilian of modern times, contended, 'that no opportunity for improvement in any study, which presented itself, should be neglected;' and he himself, while studying the law, took advantage of vacations to peruse the light works of the French and Italians, besides making a favorite pursuit of dancing and fencing. And yet, all this variety, which would be thought to distract his attention, aided in making him the greatest lawyer and most profound scholar of the age. The whole object of all the studies of Mr. Keyes tended to one grand point—the acquisition of knowledge. If his pursuits were various, they were no less correct. As a cabinet maker, a clockmaker, an apparatus maker, or a student, his work bore the stamp of a mathematical mechanic.

I have thus attempted to compile a few incidents of the life of one, worthy of the respect of all classes, but especially of that of which he was the ornament. I will not pretend to say, that he was more of an ornament to mechanics than many others who have preceded him; for there have been those, whose names have been suffered to moulder in oblivion, when they deserved to have been handed down for the admiration of posterity. But, if some have been neglected, it does not follow that we should neglect all. Instead of neglecting them, let us endeavor hereafter, to perpetuate the remembrance of those, whose lives afford an example worthy of imitation. The rapid march of intellect and improvement among the producing classes, within a few years past, awaken the fondest hopes for its permanence and duration. If this state of things should continue, biographies and examples will be needless. And we can now apparently lift the veil of futurity, and see the existence of that state, 'when in the proud career of mind our country will seek her fame.'

Mr. Keyes died Nov. 1831, at the age of 29. J. M. W.

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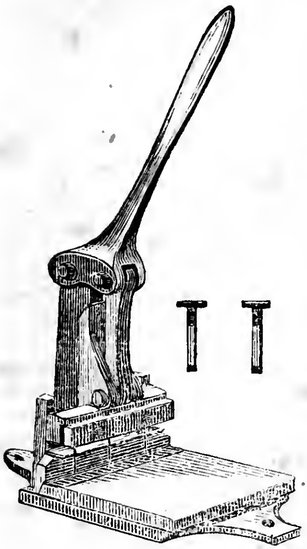
A MECHANIC who attempts to monopolize business or to injure his compeers by underselling, is guilty of high treason against society, as he violates that integrity and good will, without which the social compact would soon be broken asunder. I always suspect that such a man has not paid for his goods, or sells those of an inferior quality. GOOD.

## BOOK BINDER'S STABBING PRESS.

(Invented by the proprietor, John Mead, of Boston.)



This machine has been found to answer a valuable purpose. It requires very little power to work it, the awls being forced down by a lever which increases the power of the hand about ten times. This press is used for stabbing books for stitching, and also for strapping. The stitching awls are represented in their places in the press. They can be taken out at pleasure, or shifted to any distance apart, to suit the various kinds of work. The strapping awls are shown by themselves at the side of the plate. They can also be placed at any required distance apart in the press. The awls are made fast between plates of iron, by means of screws. There is a great saving of time and labor in the use of this press. The work is done with perfect uniformity, and much more accurately than by any other method.

It appears to us that this will prove a very useful article to book binders generally, especially to those of the larger establishments. EDS.

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New England Association of Farmers, Mechanics and other Workingmen. We observed in a recent number, that we should probably publish an abstract of the report of the late Convention from which this Association was formed. It may be only necessary to observe, however, at this late date, that the Convention was well attended; that the time was occupied by several interesting discussions; and that a number of important resolutions relating to the interests of the Workingmen were adopted. The Convention finally formed the Association named at the beginning of this notice, the Constitution of which has been published in several of the prints of the day. Auxiliary Associations have since been formed in a number of towns, and one has been instituted and is making good headway in this city. The main objects of these Associations are, the promotion of education, and the regulation of working hours.

## ANSWERS.

In answer to the question as to the pressure sustained by the ball of an air gun, I would say, it was nearly 967 lbs. on the square inch. My solution is as follows:

$4 \times 4 \times 4 = 64$, cube of the diameter of the ball.

$64 \times 0{\cdot}5236 = 33{\cdot}51$ cubic inches contained in the ball, and is equal to one atmosphere.

As 1·2 oz. is to 1728 inches, so is 1·5 oz. to 2160 inches.

$2160 \div 33{\cdot}51 = 64{\cdot}45837$ atmospheres added by the condenser.

$64{\cdot}45837 \times 15 = 966{\cdot}87555$ lbs., the pressure on the square inch.

The air which the ball contained at first must not be taken into the calculation, as that only counterbalanced the external atmosphere. There were 2160 cubic inches of air forced into the ball, which is more than 64 times its bulk; so we say the ball had a pressure of more than 64 atmospheres, or more than 64 times 15 lbs. on the square inch. T. C.

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In answer to the question respecting the column of water, I should say that three-fourths of the power would be expended on the water wheel, and one-fourth remain in the water. F.

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Messrs. Editors—In answer to the question in the last number of the mechanic respecting the number of calves which might be purchased for eighty dollars, I would say, that with eighty dollars he could purchase sixteen calves at five dollars each, and twenty at four dollars each.

As for my form of solution, I first supposed the number of calves to be 10. They would cost $8 each, adding four, making 14 at $7 would require $98. I then tried 20. They would be $4 each; adding four would be 24 at $3, amounting to only $72. This was nearer than the first supposition, but the number was too high. I afterwards tried 16 at $5, adding four, making 20 at $4, when I found it came out right. N. E. I.

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I send the following answer to the question relating to the calves in your last number:

Let $x$ represent the number of calves.

Then by terms of question $\frac{80}{x} = \frac{80}{x+4} + 1$.

By multiplication and transposition $x^2 + 4x = 320$.

Add 4 to each member of equation $x^2 + 4x + 4 = 324$.

Extracting the square root $x + 2 = 18$.

$x = 16$, number of calves.

$\frac{80}{x} = 5$, price of each.

*Answer*—16 calves at $5 each. T. S. H.

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To the question relating to the letters of the Alphabet in our last, we have received the three following answers:

15,428695,175819,469421,124000. C. W. F.

400,717299,744605,635584,000000. W.

403,291461,126605,635584,000000. T. C.

Since preparing the above answer to the alphabet question, I have been reflecting on the difficulty of forming a right conception of such high

numbers. I thought some plan might be adopted to convey a tolerable idea of the vast amount. I find that a number of bricks of 4 inches by 8 equal to the answer, would cover more than sixteen thousand millions of such globes as the one we inhabit. And if we adopt grains of sand of one hundredth part of an inch square, instead of bricks, they would cover fifty thousand such globes. T. C.

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## QUESTIONS.

Being in quest of information, I should be obliged to some of your numerous correspondents to inform me of the best method for grinding brass plates, similar to the plate of an air pump.

I would also ask your correspondent, J. M. W. if he succeeded in drying his solution of caoutchouc, and the manner in which he did it; I have tryed the same solvent repeatedly, but I never could make it dry, so that the sides would not stick together after it had been on the cloth twelve months or more. C. D.

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As there are strenuous efforts being made among the mechanics and workingmen of New England, for reducing the number of working hours, and as this measure is strongly opposed by employers and capitalists, it seems to me that a full and candid discussion of the subject in the pages of your magazine, would be quite appropriate to the work, and beneficial to your readers. I therefore request some of your correspondents to show the truth or falsehood of the following assertion: 10 hours in 24 are sufficient for a Mechanic to labor. D. B. H.

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How can the nine digits be placed so as to take their cube root without leaving a remainder.

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Messrs. Editors—I believe it has been generally observed, as I have often heard it stated by many, that the *atmosphere is never dark on a windy night.* An explanation of the cause I never saw given. Perhaps some of your correspondents may solve the mystery. **

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The Conductors of the Young Mechanic, wishing to publish information on the subject of mutual improvement, invite correspondents to communicate information relating to exercises, and also on the most proper construction of a Building for Lyceums and other societies of a similar character.

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### TO CORRESPONDENTS.

Two answers to the Apprentice question published in our second number, have been received. We have selected one, which will appear in our next. We would remind correspondents, that it is necessary that all answers to questions, as well as articles on other subjects, should be as brief as possible, as it is our wish that each number of the magazine shall contain an agreeable variety. Other articles on hand will receive immediate attention.

THE

# YOUNG MECHANIC.

VOL. I. MAY, 1832. No. V.

## OBSERVATIONS ON DRAWING INSTRUMENTS.

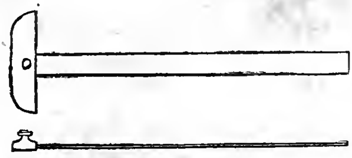
[Continued from p. 52.]

### RULERS.

RULERS for accurate purposes should be made of glass, steel or brass; those formed of the latter metals are liable to contract, tarnish and rust, and to soil the paper. Those made of ebony, boxwood or ivory, are preferred for general purposes; still no artist should be without accurate brass or steel rulers of considerable length, to lay down his principle lines, and to verify his smaller scales. A very convenient standard may be made of 3 feet or a yard in length, with one edge chamfered, and divided into feet and decimals of a foot; the other side being left the full thickness of the ruler, is used to draw lines in ink by, while the former is for the pencil, both being made very exactly straight. When rulers are made of wood, it should be of very close texture, straight grained, well seasoned, and not liable to warp. The edges which are used for the pencil should be bevelled, and those for the pen rather thicker. As the weather is so changeable in this country, the student should verify the edge of his rulers often. To do this, it is only necessary to lay the rule on some paper nicely stretched, and draw a very even line along the edge; then apply the ruler to the opposite side of the line so drawn, and if it is not perfectly straight the error will be discoverable at once, because this mode of trial doubles it, and thus renders the smallest deviation apparent. For small rulers and divided scales, ivory or ground glass is the best substance; being very smooth the drawing pen slides freely against it and draws beautiful lines. The divisions also when filled with black can be seen much better than any other substance. The only objection there is to it, is the liability to warp at every change of weather; but if carefully selected, some pieces are found to preserve their straightness without much deviation for a great length of time. The best are formed from the centre of the tooth, having the grain radiating every way from the centre of the ruler

to the edges, and thus an equilibrium is preserved in the expansion and contraction. Scales of about 12 inches in length are extremely useful for plotting. They are divided into different parts of inches, which are subdivided into tenths and twelfths. They are much more accurate and convenient for drawing than scales made on paper; the divisions being on the edge of the scales, we can prick off any distance by the compasses. A small offset scale of two or three inches in length, and graduated with divisions of the same value of those on the long scale, will often be found very useful. The ends of the offset must be exactly perpendicular to the sides, and when it is applied to the edge of the scale, which is held fast down upon the paper, while the offset slides along its edge, any number of lines may be drawn by the edge of the offset, and will always be parallel to each other. The principal object of this offset is to project points on irregular curved lines, to represent brooks, fences, ditches, &c., on maps. Such rules will be found very useful to those engaged in protracting surveys, or copying plans by squares; indeed they will be found serviceable in all cases. Parallel rulers are of various kinds. The simplest, and those in most common use, consist of two light and flat rulers, which are united together by two brass links of equal length, and the two parts on each ruler where these are joined, being of the same distance apart from a parallelogram. The joints moving freely, the two rulers may be separated and will always be parallel. In using this kind of ruler, the edge is placed to coincide with any line, and the opposite ruler held fast down to the paper; the first ruler may be pushed out to any distance from the former within the limits of the links, and always preserving its parallelism; a line may be drawn along its edge parallel to the former. As this ruler is limited in its extension, others have been contrived to obviate this difficulty; one kind being made with three rulers, the middle one closing into the others, and connected to them by four links. This kind, laboring under some of the imperfections of the first, though having been improved in various ways, (which renders it a very useful instrument,) has been succeeded by a ruler, invented by Eckhardt, a German, which is a very beautiful contrivance. It is a broad thin ruler made of ebony or brass, and has slips of ivory inlaid at its edges, which are chamfered, on which divisions of inches and decimals are marked to answer the purpose of an ordinary plane scale. This is caused to move parallel to itself by means of two small brass wheels, which are fixed to a common axis, the opposite ends of which having pivots or bearings, fit into sockets which are made on the ruler and which support it as it is moved along the paper. The wheels are slightly indented or made rough upon their circumferences similar to a small cog wheel, which gives them a hold and prevents them from slipping on the paper. Both being made of the same diameter, they carry the rule forward equal distances, and thus the edge always moves parallel. The distance which the ruler moves is measured at the same time by two small wheels of ivory, fitted on the axis by the side of the brass wheels, which

have divisions on their circumferences, which are so proportioned to the size of the ruler that each division is equal to one-tenth of the rulers motion, and these may be subdivided by sight. The divisions are read against an index which is made upon the little piece of brass which sustains the pivots of the axes of the wheels. In rolling the ruler, one hand only must be used, and the fingers should be placed very nearly in the centre, that one end may tend to move as fast as the other. The edge should be raised a little from the paper as it moves, so as to allow the wheels only to touch it; and the surface of the paper should be very smooth and free from protuberances. To draw lines at *determined* distances from each other, if the rule is moved from you, the distance is to be adjusted by the right hand ivory cylinder; if towards you, the left is to be used. This rule is exceedingly useful to raise and let fall perpendiculars to given lines; to do so, we have only to place the edge of the ruler to the line, bringing some division against the given point, which the perpendicular is to pass through, then rolling the ruler, we mark off either above or below the line, a small point with a protracting pin or pencil, against the assumed division, then lifting up the ruler we draw the perpendicular. Many other parallel rulers have been invented, but after all, none are so accurate, or possesses such evident advantages as the common T square or bevil, which is used against the side of the drawing board. The inconveniences attending this when we have not a drawing board at hand, gave rise to the many contrivances which have been enumerated. This as commonly used is too well known to require any description; but the best and most convenient kind is made of mahogany, or some other kind of wood which is well seasoned, and consists of a long flat rule about three feet in length, two inches broad and an eighth of an inch thick, one end of which is fitted into another piece about 9 inches or a foot long, and having a screw with a milled head passing through it for clamping it to the blade, and which serves for a pin for the rule to turn on. This rule may be constructed by any joiner. The annexed figure represents the best kind. It is intended to answer the double purpose of a square and bevel. The effect which every change of weather has upon the T square, soon deranges it and renders it useless. Therefore I would advise the student to have two bevels made in preference. The tongue may be adjusted in a very simple manner perpendicular to the side of the stock by laying it on the drawing board, and drawing a fine line against the edge of the ruler, then reversing the ruler, and drawing another line through some point in the former. The error if any occurs will be doubled. The angle which is made by the two lines so drawn may be divided equally and the blade of the ruler adjusted to the new line, which will be perpendicular to the edge of the stock. Small triangular pieces of boxwood or ivory to slide on the edge of the ruler are very convenient for



drawing lines perpendicular or parallel to one another. The student should provide himself with two, the angles of one being 90° and 45° and those of the other 90°, 30° and 60°, the latter being much used in isometrical perspective. Another useful instrument for the same purpose, may be made of two rulers jointed at the end like a sector, and having a small screw for clamping, similar to the screw on the bevel. The inside edges may be chamfered and divided into inches and tenths, which may be used for drawing lines parallel and anti-parallel, or reversed, or making the same angle in the opposite direction. It will also when applied to the edge of a ruler divide a line into any number of equal parts, which may be effected as follows. Thus for instance, suppose the space between any two points *a* and *b* upon any line *ab*, is to be divided into 7 equal parts, open the ruler and bring the division 7 on the inside against the point *b*, then stretch open the rulers so as to take in the whole line *ab*. Place the edge of a long ruler against the lower limb of the bevel, and slide the bevel against the ruler till the division 6 intersects the line *ab*, then draw a mark by the edge of the bevel cutting the line *ab* at 6, move the ruler again to 5 and proceed in the same manner, and so of all the rest and the line will be divided in 7 parts. It is plain that if it had been requested to divide it into $7\frac{1}{3}$, it could be done in the same manner, by opening the bevel so much more as to bring the division $7\frac{1}{3}$ against *b*, instead of 7. It is for these fractional numbers that the instrument is chiefly useful, because it is so difficult to do them by compasses.

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## ARTS AND MANUFACTURES.

The arts and labors of the present age are signally characterized by the extensive and powerful application of steam. By means of this mighty agent nature has been conquered, her strong holds invaded, and her treasures laid bare. Urged by its powerful influence, man glides with immense velocity over the waters, rushes like the wind along the earth, and exerts a power over matter which, in force and intensity, almost equals the elements of nature.

It requires no great effort of the imagination to conceive, that those two mighty forces, gravity and heat, that hold together the principles and govern the operations of the material universe, have been made to yield a portion of their essence to facilitate the labors of man, and have thus enabled him to triumph over the laws and productions of nature.

The application of steam to the working of the press may justly be regarded as among the most important of its uses, since it extends the usefulness and augments the effects of printing by diminishing the labor and expense once attending this department of art. When we reflect upon the immense capacity of steam,

'fancy's busy work begins,' and we look to the time, when by means of its power, man will effect operations hitherto unknown in the history of art, and not conceived of even by the most imaginative mind.

The application of steam to locomotion and the propelling of vessels, is peculiarly worthy of notice; for it is one of the most useful inventions of the present age. By means of this application of the force, distant countries are brought into close communion, and thus the interest of commerce as well as manufactures is promoted, and what was once considered a toilsome journey or a long voyage, is now deemed merely an excursion of pleasure.

We have every reason to believe that this application of steam will ere long be very extensive and useful; since it is by means of it that vehicles are propelled upon railroads—those immense aids to human labor, which arouse such a spirit of enterprise in the towns and regions through which they pass; and in our own country if extended in their operations and number, they will not only minister to its general prosperity, but will serve the important purpose of connecting bands between the different states, and thus by joining their interests tend greatly to preserve that sacred union which exists between them. 'It is to that union we are indebted for all that makes us most proud of our country; it is to that union that we owe our safety at home and our dignity and consideration abroad.'

New England has attained a well merited character for her enterprise and invention. The province in which she seems most distinguished and which has obtained for her a just fame, are the improvements and additions she has made to machinery. Her inventions in this department have contributed to perfect the manufacture of many articles and to lessen the labor which formerly attended it. There is perhaps no branch of art to which the people of New England can better turn their attention, than the improvement and invention of machinery. It was but a few years ago that we were dependent upon Great Britain for almost every article connected with apparel, except the coarser materials of clothing. But manufactures have sprung up and extended their operations among us; and we may fairly anticipate the time when the rich silks of France, the fine cloths and cutlery of England, and even the gay plaids of Scotland, will be manufactured in abundance 'on the shores of America.' The air we breathe is free, the earth we tread is free. May the time come when our dress, our conveniences and even our luxuries shall all be American! Here where the spirit of freedom burns, may the spirit of enterprise and invention glow with equal intensity.

If we owe our progress in arts and manufactures to any particular influence, it is to that which education exerts, and it is to that we are to look for our future advancement. But there are other incentives which are capable of exerting a great and beneficial effect. The rising generation must understand the claims which the arts and manufactures have upon their attention and exertions.

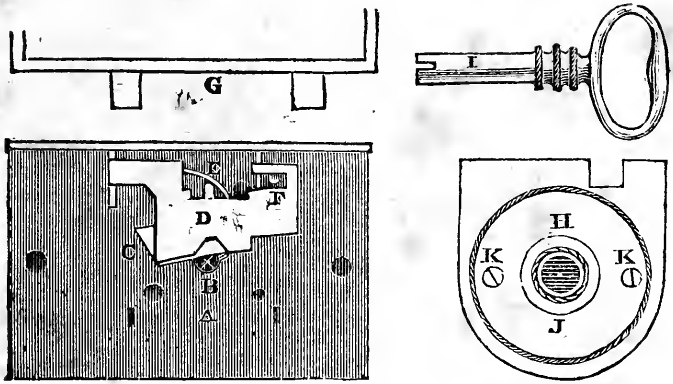
If there is any object which should interest the feelings and receive the attention and labors of man, it is the cultivation of arts and manufactures.

Situated as he is, with daily and hourly returning wants, subject to constant and various vicissitudes, it should be his study, as well as his pleasure, to exercise his faculties for the good of his fellow beings. Nature presents her varied stores in rich profusion, and God has given him a mind capable of constant and improving action.

The works of nature appear to have been created to employ the mind and augment the happiness of man, and her laws seem to have been framed to assist him in applying her principles to his own purposes. If the vegetable creation is adapted to feed the body, it is no less calculated to afford opportunity for the useful exercise of the mind. If the works of nature tend to excite feelings of adoration by their grandeur and beauty, they produce this effect in no less degree by their utility and adaptation to the wants and powers of man. Although the field of literary labor presents an opportunity for the most useful and honorable exercise of the mental faculties, yet that which the arts and manufactures afford is both extensive and accessible.

Every monument of human ingenuity and skill, as well as every effort in the department of literature, is a substantial proof that the sacred powers with which man is vested, have been neither squandered nor abused. The individual who has made useful discoveries in nature and new improvements in the arts, will be remembered with grateful emotions by his fellow beings, long after the trophies of the soldier have mouldered in oblivion; for he has benefitted his country, not by the blood he has shed, but by the additions he has made to her resources and usefulness.

It is however evident, that the full amount of good which may be reasonably anticipated from the progress of arts and manufactures, will only be realized in proportion as they become subjects of deep study and profound research. Mental labor is as essential to their promotion and perfection, as it is acknowledged to be indispensable in every work which has for its object any real and permanent good. The fact will strike every individual with peculiar force, who will survey the present practical condition of the mechanic arts, and see how much of mechanism and little of science is evinced. With us it is, comparatively, a new thing to treat the common arts of life, as subjects of mental investigation as well as of physical labor. But a new interest has been awakened in the subject, the happy influences of which are already evident, no less in the avidity with which useful knowledge is sought, than in the successful efforts of those institutions which have for their object its general diffusion.




## ELLINGTON'S PATENT LOCK.

I TAKE the liberty of submitting, for your inspection, a lock (for which I have obtained a patent,) which, in itself, I may say (with the greatest mechanics who have seen it,) is the most secure and simple now in use.

A is the brass plate of the lock. B the pin which goes into the pipe of the key, having at the lower part a circular piece of brass, which revolves round it; this has four slits to receive the corresponding parts of the key. C the tumbler. D the bolt. E the spring to keep down the bolt. F the pin to secure the bolt in its place. G the staple (double link.) H the cap. I the key. K K the screw holes of cap. J the bush, or pipe.

The advantages of this lock will be obvious from the description. Instead of a great heavy key, with a large bit of iron (called a bit,) being required, as in locks of the kind now in vogue, you have a key so small, that it may be attached to the watch-chain; nor is there any possibility of the bit breaking in the lock, as is sometimes the case, and valuable articles of furniture being thus destroyed or damaged.

In the next place, there are no wards to break or bend; the brass circular revolving talon answers the place of the wards, shooting the bolt as it goes round. The slits answer the purpose of keeping out any false pipe or skeleton key which might be introduced. The cap of the lock is made with a large bush, similar to Mr. Bramah's patent, so as to leave no possibility of a picker entering.

The price of Mr. Bramah's lock is 8s. 6d.; but the utmost which can, with propriety, be charged for mine, is only 1s. 6d.; while it is equally, if not more, secure. Any of my make I will warrant beyond all possibility of being picked. SAM. ELLINGTON.

*Lond. Mech. Mag.*

## THEORY AND PRACTICE.

It will not be denied, that the prosperity of this country depends in part on our *manufactures;* and these again, depend on improvements in *science* and the *mechanic arts.* No man can be said to be a finished workman, if he is ignorant of the *theory* on which his *practice* is founded. A man who is well versed in *arithmetic* and *geometry*, together with the laws or properties of *simple machines*, (improperly called *mechanical powers*,) with their effects, when combined, as in *compound machines*,—I say a man that understands these, and the laws of attraction, of simple and compound forces, the various properties of *æriform* and *watery* fluids, with some knowledge of *chemistry*,—such a man, if he sees a plan on paper, hears it described, or reads of it, especially if he is a *practical man*, will be able to judge of its merits more correctly, in less time and consequently at less expense, than if he were merely a workman. In the latter case he must construct his model. If this is done in a bungling manner, it will not perform, but he may conclude it would if it had been well made. This is all guesswork. I recollect reading an observation which goes to confirm this; 'that if a plan of the steam engine had been shown to Archimedes, he would have been able at once to say what it was capable of doing—that is, whether it would work, and what power it possessed.' Now if our mechanics understood the principles of science, what time and expense would be saved.

PHILO.

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## MEMOIR OF THE LIFE OF EDMUND STONE.

Edmund Stone, a distinguished self-taught mathematician, was born in Scotland; but neither the place nor time of his birth are well known; nor have we any memoirs of his life, except a letter from the Chevalier de Ramsay, author of the 'Travels of Cyrus,' in a letter to Father Castel, a Jesuit at Paris, and published in the 'Memoirs de Trevoux,' p. 109, as follows:—'True genius overcomes all the disadvantages of birth, fortune and education; of which Mr. Stone is a rare example. Born the son of a gardener of the Duke of Argyle, he arrived at eight years of age before he learned to read. By chance a servant having taught young Stone the letters of the alphabet, there needed nothing more to discover and expand his genius. He applied himself to study, and he arrived at the knowledge of the most sublime geometry and analysis without a conductor, without any other guide but pure genius.

At eighteen years of age he had made these considerable advances without being known, and without knowing himself the prodigies of his acquisition. The Duke of Argyle, who joined to his military talents a general knowledge of every science that adorns the mind of a man of his rank, walking one day in his garden, saw lying on the grass a Latin copy of Sir Isaac Newton's

celebrated "Principia." He called some one to him to take and carry it back to his library. Our young gardener told him that the book belonged to him. "To you!" replied the Duke, "Do you understand geometry, Latin, Newton?" "I know a little of them," replied the young man, with an air of simplicity arising from a profound ignorance of his own knowledge and talents. The Duke was surprised; and having a taste for the sciences, he entered into conversation with the young mathematician: he asked him several questions, and was astonished at the force, the accuracy, and the candor of his answers. "But how," said the Duke, "came you by the knowledge of all these things?" Stone replied: "A servant taught me, ten years since, to read: does one need to know any thing more than the twenty-four letters in order to learn every thing that one wishes?" The Duke's curiosity redoubled; he sat down upon a bank, and requested a detail of all his proceedings in becoming so learned. "I first learned to read," said Stone: "the masons were then at work upon your house: I went near them one day, and I saw that the architect used a rule and compasses, and that he made calculations. I inquired what might be the meaning and use of these things; and I was informed that there was a science called arithmetic. I purchased a book of arithmetic, and learned it. I was told there was another science called geometry. I bought the books, and I learned geometry. By reading I found that there were good books on these two sciences in Latin. I bought a dictionary, and I learned Latin. I understood also that there were good books of the same kind in French. I bought a dictionary, and I learned French. And this, my lord, is what I have done. It seems to me that we may learn every thing when we know the twenty-four letters of the alphabet." This account charmed the Duke. He drew this wonderful genius out of his obscurity; and he provided him with an employment which left him plenty of time to apply himself to the sciences. He discovered in him also the same genius for music, for painting, for architecture, for all the sciences which depend on calculations and proportions.

"I have seen Mr. Stone. He is a man of great simplicity. He is at present sensible of his own knowledge; but he is not puffed up with it. He is possessed with a pure and disinterested love for the mathematics; though he is not solicitous to pass for a mathematician; vanity having no part in the great labor he sustains to excel in that science. He despises fortune also; and he has solicited me twenty times to request the Duke to give him less employment, which may not be worth half of that he now has, in order to be more retired, and less taken off from his favorite studies. He discovers sometimes, by methods of his own, truths which others have discovered before him. He is charmed to find on these occasions that he is not a first inventor, and that others have made a greater progress than he thought. Far from being a plagiary, he attributes ingenious solutions, which he gives to certain problems, to the hints which he has found in others, although the connection is but very distant," &c.

Mr. Stone was author and translator of several useful works; viz. 1. "A new Mathematical Dictionary," in 1 vol. 8vo. first printed in 1726. 2. "Fluxions," in 1 vol. 8vo. 1730. The Direct Method is a translation from the French of Hospital's "Analyse des Infiniments Petis;" and the Inverse Method was supplied by Stone himself. 3. "The Elements of Euclid," in 2 vols. 8vo. 1731. A neat and useful edition of these Elements, with an account of the life and writings of Euclid, and a defence of his Elements against modern objectors. Beside other smaller works. Stone was a fellow of the Royal Society, and had inserted in the "Philosophical Transactions," (vol. xii. p. 218) an "Account of two species of Lines of the third Order, not mentioned by Sir Isaac Newton or Mr. Stirling." *Lond. Artisan.*

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## PATENTS FOR MASSACHUSETTS.

GRANTED IN JUNE, JULY, AUGUST AND SEPTEMBER, 1831.

*June.*

32. For machinery for *washing rags in the manufacturing of paper*. David Ames, Jr., and John Ames, Springfield, assignees of Samuel Eckstine, Philadelphia, June 13.

33. For a *washing machine*. Samuel Jinkham, Enfield, June 13.

34. For a *churn*. Philip H. Kimball, Salem, June 13.

35. For a machine for *separating grain, rice, peas, grass-seed, flax-seed, &c.* from the straw, and for cutting straw. Abel Lock, Pittsfield, June 13.

*July.*

36. For an improvement in the *making of pasteboard or other paper*. Frederic A. Taft, Dedham, July 20.

37. For machinery for *cutting leather*, or other substances into any desired shape at one operation. George Domett, Boston, July 20.

38. For improvements in the construction of *candle moulds*. Timothy J. Dyre, and Anthony Richmond, New Bedford, July 20.

39. For a *plough*. Barnabas Thatcher, Jr., Barnstable, July 20.

40. For a machine for *making hooks and eyes*. James Stewart, formerly of Montrose in Scotland, but for two years past a resident of Boston, July 20.

41. For a *compound revolver for roping cotton*. Asa Whitman, and Joel Baker, Walpole, July 20.

42. For an improvement in the *printing press*. Otis Tufts, Boston, July 30.

*August.*

43. For machinery for *jointing staves*. Isaac Forbes, Bridgewater, August 3.

44. For an improvement in the common *pump* for pumping water. Jesse Reed, Marshfield, August 5.

45. For *shears for cutting pasteboard, sheet iron &c.* Alvah Hardy, Boston, August 12.

46. For improvement in the mode of *fastening the soles and heels upon a boot or shoe*, with wooden or metal pegs, and of paring the same. Wales Tileston, Charlemont, August 18.

47. For an improvement in the art of *distillation*. John Cairou, Boston. Patent issued January 10, 1831; surrendered on account of a defective specification, and resumed August 22.*

48. For an improvement in the mode of *making beds*, called the 'spring bed.' Josiah French, Ware, August 25.

49. For a machine for *making clapboards from round logs*. Herald Whittemore, Worcester, August 26.

*September.*

50. For a machine for *shelling and cleaning corn*. Jesse Reed, Marshfield, Sept. 1.

51. For an *anthracite cooking stove*. Walter Bryant, Boston, Sept. 13.

52. For a *shingle machine*. Chery Reed, Worcester, Sept. 28.

53. For an economical *baker and roaster*. Philip Wilcox, Springfield, Sept. 28. *Journal Franklin Institute.*

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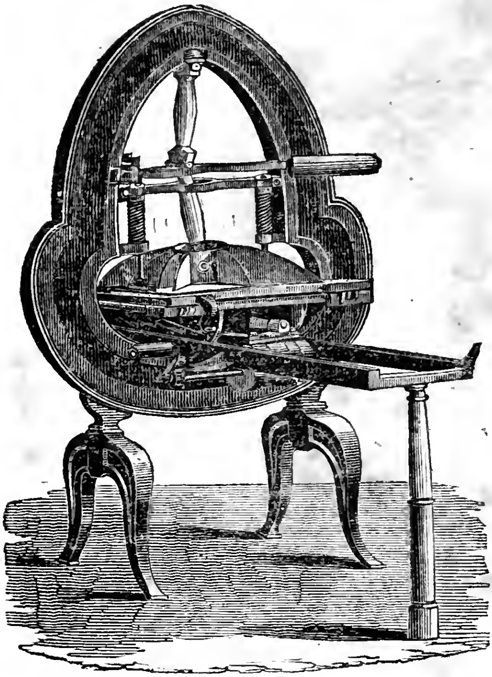
## OIL FOR DELICATE MACHINERY.

The oil for diminishing friction in delicate machines, ought to be completely deprived of every kind of acid and mucilage: and to be capable of enduring a very intense degree of cold without freezing. In fact, it ought to consist entirely of *elaine* or the *oily* principle of solid fat, and to be perfectly free from *stearine* or *solid fat*.

Now it is not a difficult matter to extract the *elaine* from all the fixed oils, and even from seeds, by the process recommended by Chevreul, which consists in treating the oil in a matrass with seven or eight times its weight of alcohol till boiling. The liquid is then to be decanted and exposed to the cold; the *stearine* will then separate from it in the form of a crystallized precipitate. The alcoholic solution is afterwards to be evaporated to a fifth part of its volume, and the *elaine* will then be obtained, which ought to be colorless, insipid, without smell, and incapable of altering the color of the infusion of litmus or turnsole, and having the consistence of pure white olive oil. *Select.*

* This patent was rendered defective by Mr. Cairou supposing that if he sent a good model instead of a drawing, and reference in his specification to the model, it would answer the same purpose as a drawing; an error into which inventors often fall, from not understanding the Law of Patents.—The law says: 'and shall accompany his specification with drawings and written references thereto, wherever the nature of the case admits of drawings.' The Secretary of State has the power vested in him of requiring the patentee to furnish a good model of his invention if he deems it necessary, which model is preserved in the Patent office for the information of those visiting the office, and is no farther than this connected with or essential to the specification. EDS.



## TUFTS' PRINTING PRESS.

THE above cut is a representation of a very beautiful hand printing press constructed and patented by Mr. Otis Tufts of this city. The elegant form of the arch, we may safely say, surpasses all others, and reflects great credit on the inventor. The movements are very simple and easy; by a peculiar combination of the parts the pitman is driven forward in a straight direction, and acts always perpendicularly on the progressive levers or 'toggle joints;' while in most of the other presses they are straightened by their pitmans acting diagonally to them. We discover in viewing this press that Mr. Tufts has calculated his arch upon the truest mathematical principles, to bear a powerful strain before breaking; and we should not hesitate to say that the same quantity of metal converted into an arch of the above form would bear a much greater strain before it separated than it would in any other arch now in use. We judge of the utility of the press from the many testimonials in its favor from the printers of Boston and others who have used it. We hope it will prove a source of profit to the maker, and cheerfully recommend it to the attention of the public.

## SINGULAR APPLICATION OF HEAT.

Some years ago it was observed, at the *Conservatoire des Arts et Metiers* at Paris, that the two side-walls of a gallery were receding from each other, being pressed outwards by the weight of the roof and floors. Several holes were made in each of the walls, opposite to one another, and at equal distances, through which strong iron bars were introduced, so as to traverse the chamber. Their ends outside of the wall were furnished with thick iron discs, firmly screwed on. These were sufficient to retain the walls in their actual position. But to bring them nearer together would have surpassed every effort of human strength. All the alternate bars of the series were now heated at once by lamps, in consequence of which they were elongated. The exterior discs being thus freed from contact of the walls, permitted them to be advanced farther, on the screwed ends of the bars. On removing the lamps, the bars cooled, contracted, and drew in the opposite walls. The other bars became in consequence loose at their extremities, and permitted their end plates to be further screwed on. The first series of bars being heated, the above process was repeated in each of its steps. By a succession of these experiments they restored the walls to the perpendicular position; and could easily have reversed their curvature inwards, if they had chosen. The gallery still exists, with its bars, to attest the ingenuity of its preserver, M. Molard. *Select.*

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## NOTICES OF NEW PUBLICATIONS.

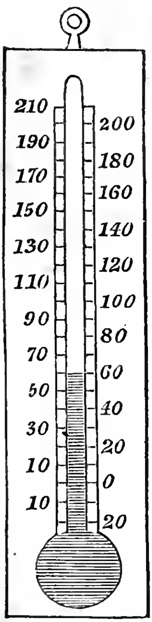
The North American Arithmetic. Part Second—uniting Oral and Written Exercises in Corresponding Chapters—by Frederick Emerson, late principal in the department of Arithmetic, Boylston School. Boston, Lincoln & Edmands. 12mo. pp. 192.

This very neat little volume is on the *inductive* principle, and is divided into two parts. The questions in the first part are to be answered verbally; those of the second part are done on the slate. This book is adapted to teaching in *classes.* By this method it is said more pupils may be taught in the same time, and that they will learn faster. The whole work seems to have been prepared by an experienced teacher. Fractions are treated in a very clear manner. There are a variety of *cuts* to explain them inserted in the pages where the questions occur. We think this a valuable addition to our school books, and that it might be studied with advantage by our young mechanics.

We would suggest the propriety of reversing the *period* for a *decimal point,* so as to bring it half way up the type or figure. Many mistakes have been made in taking decimal fractions for whole numbers. By this method the mark would be known from all others, and mistakes would be less frequent. This plan is adopted in the Young Mechanic and some other works.

Elements of Natural Philosophy, with Practical Exercises, for the use of Schools—by Francis J. Grund, author of an Elementary Treatise on Plane and Solid Geometry, &c. Boston, Carter & Hendee, and Richardson, Lord & Holbrook. 12mo. pp. 278.

This book, like the former works of Mr. Grund, we think will be well received. It is written in a clear, familiar style, is very concise, contains sound matter, and embraces the recent discoveries in the science of which it treats. The work contains ten chapters, which are subdivided into three hundred and fifty-four sections, with an appendix of questions, numbered to correspond with the sections in the body of the work. There are also notes containing mathematical calculations, and questions to these, also, in notes, which may be used or not according to the taste or ability of the learner. The cuts are numerous, well executed, and placed where they can most readily be examined. We extract the following from the section on the thermometer:




The expansion of bodies by heat, and their contraction by cold, afford the means of measuring degrees of temperature. The instrument used for this purpose is called a *thermometer*. It is made of a hollow glass tube, which, having a hollow ball at the bottom, is nearly half filled with quicksilver. When this is done, the whole is heated until the quicksilver rises quite to the top. The top is then hermetically sealed; that is, so as perfectly to exclude all communication with the outward air. Then, in cooling, the quicksilver contracts, and consequently its surface descends in the tube, until it comes to a point which corresponds to the temperature of the air. When the atmosphere becomes warmer, the quicksilver expands, and rises in the tube; and contracts and descends again, when the atmosphere becomes cooler. By the side of the tube is placed a scale which is prepared thus:—The thermometer is brought into the temperature of freezing, by immersing the ball in water just freezing, or in ice just thawing, and the scale is marked where the quicksilver then stands, for the point of freezing. Then it is immersed in boiling water, and the scale again marked, where the surface of the quicksilver then stands. The distance between these two points is divided into 180 equal divisions or degrees, and the same degrees are continued 32 degrees further below, which point is then called zero; and as much below zero and above the boiling point, as is convenient; so that there are 212 degrees from the boiling point down to zero.

Quicksilver is now generally used for thermometers, it being very susceptible to the different degrees of heat; enduring great heat before it becomes transformed into vapor, and great cold before it becomes solid.

## ANSWERS.

Messrs. Editors—I observe the question 'Whether ten hours in twenty-four are sufficient for a mechanic to labor' is proposed for discussion in the pages of your Magazine; I therefore take the liberty of offering a few remarks on the subject, which, if destitute of other merit, may claim that of impartiality, as I am free from that excitement at present prevailing on the subject, and feel no personal interest in its decision.

The custom of working 'from sunrise to sunset,' which I believe has prevailed to a great extent among the mechanics of Boston, if not New England in general, is so absurd, and liable to so many objections, that I think a reform was certainly called for—but I cannot perceive the reasonableness of establishing the *same* specific number of hours of labor, (whether it be 10, 11 or 12,) for *every* trade without distinction or discrimination, and without regard to the fact of its being of a light or laborious nature;—the workmen out of doors or in—exposed to the heat and cold, or in a shop, enjoying the comforts of fire in winter, and shade in summer. These are circumstances which I conceive are worthy of consideration in the minds of reasonable and reflecting men, and a disregard of which, in deciding this question, would be acting on the principle of establishing a certain number of bushels of coal as a load for a horse, without regard to the circumstance of its being charcoal or anthracite, or the conveyance upon a rough road or railroad. Another consideration strikes me as deserving of notice, viz. that the nature of some trades is such, as in general to preclude their being worked at with convenience or safety, unless by daylight, which in Boston in the shortest days would fall short of ten hours, without any allowance for meals.

I have thrown out the above remarks rather by way of suggesting subjects for the consideration of those who may undertake to decide this question, than of attempting to answer it myself. Whenever work can be done by the piece, either at stipulated prices, or a certain quantity for a day's work, I think it in general, an arrangement more satisfactory to both parties, than that of working by the day; but as this cannot always be done, I am free to state as my own opinion, that I think ten hours of labor in twenty-four might be considered as a fair proportion for masons and carpenters engaged on buildings, from the nature of the work, which is laborious, and attended with exposure to the weather, and cannot be injured by competition from foreign importation. The same rule might be applied to other trades which are laborious; but as to those of a different character, and which, perhaps, have to contend with articles of foreign importation, I conceive eleven hours to be no more than reasonable. I might offer arguments in support of the sentiments advanced, but a due regard to brevity forbids it. I can only express a hope that all parties concerned in the decision of this question may act in accordance with the golden rule—remembering their interests in many respects are mutual—meeting each other in the spirit of good will—let the employer remember he was himself once of the class of the employed, as his children may also be; and let the employed reflect that they may themselves become employers, and that it is their mutual interest to settle the question, not on selfish principles, but on the principles of justice and reason. R. E. R.

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I observed a communication in the last Mechanic from C. D., in which he says he has repeatedly attempted to use caoutchouc, by dissolving it in the naptha from coal tar, (as recommended in an article on this subject, published in No. 3. p. 40,) but that he has never succeeded to his satis-

faction; for, although the naptha would readily dissolve the gum, yet it would not be dry, even after remaining exposed for twelve months; and he requests information in regard to the method of drying this solution. In answer to his request, I will endeavor to point out what I conceive to be the difficulty in his experiments. It may be seen in a note, appended to the article in question, that the distillation of the naptha, must be conducted at a *very gentle* heat. It is probable that more care is necessary in regard to the heat applied, than would generally be supposed. The reason is this, by a small increase of heat, a quantity of impure volatile oil is disengaged, and passes into the matrass mixed with the naptha. Although this compound will dissolve India rubber, yet, after the evaporation of this supposed naptha, a residuum will be left from the volatile oil, which will not evaporate, but will prevent the rubber from drying, or becoming elastic, and by this means disappoint the expectations of the experimentalist. If the naptha procured from one distillation should not prove to be pure, it can be made so by distilling it over. If this answer should be sufficiently clear for C. D. to give it a fair trial, with the precautions I have named, and his experiment should not be successful, I should be pleased to hear from him again, together with the results of his experiment, through the pages of the Young Mechanic.

J. M. W.

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In answer to C. D. respecting grinding brass plates, probably I am not in possession of the best method, but the following will do very well. Procure a flat stone on which sift house sand rather fine; use water with it, and rub your plate on this stone, taking a sweeping motion similar to grinding paint; change the position of the plate very often. Flour of emery may be used, and plates of metal instead of stone. T. C.

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## QUESTIONS.

I should be obliged to some of your correspondents to inform me of the process of transferring prints from paper to glass. I have tried various methods, but from some cause do not succeed. D. C. M.

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With four weights any number of pounds from one to forty can be weighed with common scales. What is the weight of each of the four?

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Suppose a barrel containing 20 gallons to be half full of pure cider, and every time a pint is drawn from the barrel a quart of water is immediately added—when the barrel is full, how much cider will remain, the water diffusing itself equally through the cider? ☞

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### TO CORRESPONDENTS.

We have received a communication from J. R. C. it shall appear in our next. His offer is acceptable. Gulielmus is also received and shall have a place. An article on the apprentice question promised in our last is in type, but is unavoidably deferred till our next.

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Errata.—In the last number, 54th page, and 14th line from the bottom, for *locomotions*, read *locomotives;* and 55th page, and 15th line from the bottom, for *Anderson,* read *Androssan.*

THE

# YOUNG MECHANIC.

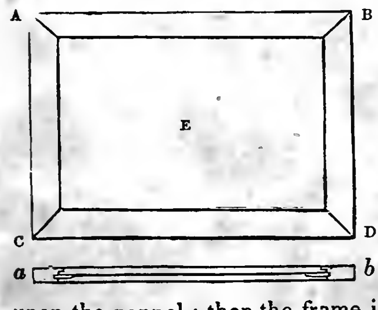
VOL. I. JUNE, 1832. No. VI.

## OBSERVATIONS ON DRAWING INSTRUMENTS.

Continued from p. 68.

### THE DRAWING BOARD.

THERE are many different forms of the drawing board, some being only plain pieces of pine with square edges, the paper being glued, or confined by tacks, or small pins with large flat heads. Another means of securing the paper, is by a long screw which passes through the board, and which has a very thin square or octagonal head, which drops into a small cell made in the top of the board. On the opposite end is a nut by which the head of the screw, after it is passed through the paper, is drawn close into the cell, and thus at the same time makes no elevation above the surface of the paper, which can obstruct the passage of the square or other rulers over it. The best and most convenient kind of drawing board consists of a rectangular frame, ABCD, represented below, of mahogany, into which a pannel E, of some kind of well seasoned wood is fitted, and secured by buttons or cleats, as seen in the section at *ab*. They are made of all sizes, but that which is intended for a half sheet of the imperial paper, will be found generally speaking the most useful. The paper is to be damped with a clean, soft sponge on the side on which the maker's name appears, and laid upon the pannel; then the frame is placed upon it, and pressing it down, the pannel is forced in, which is to be immediately buttoned all round. When dry, the paper will present an even and uniform surface for drawing on. There has been some improvement made in this kind of board; the frame has slips of box or other light colored wood inlaid, and these being divided into those scales which



are most frequently required, will be found very convenient to work from without compasses. The divisions on the adjacent sides of the board are of the same scale, but those on the opposite are of different values. This renders the use of the board more extensive, because it is the two adjacent sides only which are used for the same drawing, one being for the measurement of length upon it, the other for the heights of elevation. The student may easily ascertain at any time if the two sides of his drawing board preserve their perpendicularity to each other, simply by setting his bevel square as before explained, and applying it to the edges of the board. This should always be done once or twice a week, and particularly if any sudden change in the weather has occurred since last using it. If any derangement has taken place in the meantime, he should have it put in proper order before using it. Attention to these little matters always denotes a good workman, and cannot fail to produce his drawings all the credit due them.

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## SPOUTING OF FLUIDS.

Hydraulics is a science which treats of the velocity of fluids. It has always been considered a curious and interesting inquiry, to investigate the causes by which water spouts from several vessels to different heights and distances.

Upon the principles of hydraulics, many useful machines are constructed; and many kinds of mills, several engines used in the mechanic arts, pumps, fountains, &c., are the effects of hydraulics judiciously applied. If we knew with certainty the mass, the figure, and the number of particles of a fluid in motion, the laws of its motion might be determined by the resolution of a mathematical problem, viz. by finding the motion of a system of small free bodies acting, one on another, by the influence of some exterior force, as that of gravity. But we are very far from being in possession of the data requisite for the solution of this problem; and if we were, it would be difficult to deduce any satisfactory results from the intricate calculations in which the question would be involved. Some have attempted to infer the laws of motion in fluids from the equilibrium of their particles; but these are so complicated as to be of no particular use. Accurate physical investigation is previously necessary. Those who wish for clear ideas on the subject, should endeavor to establish their physical principles on experimental facts and accurate observations. When water spouts from a hole in the bottom of a vessel, it first descends in a vertical direction, and the surface deviates very little from a horizontal plane, but at about three or four inches from the bottom the particles turn from the vertical direction, and proceed from all parts with a motion, more or less oblique towards the aperture. The same thing takes place when the water spouts from a small hole in the side of a vessel. The tendency of the particles towards the orifice is a necessary consequence of their perfect

mobility; for they are thus naturally directed to that part where they meet with the least resistance, which part is the aperture.

At a small distance from the bottom of the vessel, the fluid forms itself into a kind of funnel, whose point corresponds with the centre of the hole. When the fluid runs out of a hole in the side of a vessel, it forms a kind of *half funnel*, beginning when the surface nearly touches the upper edge of the hole. It is probable that the funnel begins to be formed as soon as the fluid begins to run, but it does not become very sensible, except when the surface is at a small distance from the bottom.

The funnel commences at a greater height from the bottom of the vessel in proportion as the bottom is larger. The size, however, is varied from a number of circumstances.

The velocity of a fluid spouting from a small hole in the bottom of a vessel is equal to that which a heavy body would acquire in falling perpendicularly from a height equal to that of the surface of the fluid above the aperture.

The same law takes place when the hole is in the side of the vessel; for the pressure of the fluid is equal, at the same depths in all directions, and will consequently produce the same velocities.

The velocity of a fluid issuing from the hole will carry it to the same height as the surface above the aperture, in the same manner as a body falling from a certain height acquires a velocity sufficient to make it ascend to the height from which it falls.

From the theory of falling bodies, we infer, that if the fluid continued to move uniformly with the velocity it had acquired at coming out of the aperture, it would move through a space equal to double the height of the fluid above the aperture, while a heavy body was descending through the same space. The height being the same, the velocity of the fluid above the aperture will be always the same, and this, though the fluid varies in density; for though with a denser fluid the pressure is greater, the mass escaping is also greater; and the velocities are equal when the moving forces are proportional to the masses they put in motion.

The spouting of fluids through lateral orifices depends upon this principle—that the pressure against the side of a vessel increases in proportion to the depths, but the velocity of a spouting fluid, which depends upon the pressure, increases only as the square root of the depths. Suppose a vessel having two pipes, or orifices, one an inch from the surface of the fluid, and the other four inches, the latter will discharge double the quantity of water in the same time as the former.

The velocity of water spouting from an orifice is continually decreasing in the following proportion, as 9, 7, 5, 3, 1.

That is, if a vessel be divided into 25 parts, and filled with water, and a hole be made in the bottom, 9 parts will run out, say in one minute; 7 in the next, 5 in the third, 3 in the fourth, and 1 in the fifth, agreeably to the above position. On this principle, Sir Isaac Newton's water clock, or *clypsidra*, was constructed, which would keep very exact time as long as the water was running out,

which was through a very small aperture. It may be constructed in the following manner. Take a small cylindrical vessel, and having ascertained the time it will take to empty itself, divide by lines the vessel into particles which are to one another as the odd numbers 1, 3, 5, 7, 9, 11, &c. Thus suppose a vessel require 36 hours to empty itself, divide it first into 36 parts, then beginning at the surface take 11 of these parts for the first hour, 9 for the second, 7 for the third, and so on to the last, and it will be found that the surface of the water will descend regularly through each of these divisions in an hour.

If a prismatic vessel be filled with water, and the water be allowed to run out by an aperture in the bottom, observe the time employed in running out. When empty, again fill the vessel, keeping the surface of the water at the same height. In the same interval of time in which the vessel was emptying itself in the first instance, nearly double the quantity of water has been expended in the second.

In practice, the water often issues from lateral openings, which, though small, in comparison to the size of the reservoir, cannot be considered as having all their points at an equal distance from the surface of the fluid. In these cases, the usual method of ascertaining the quantity of water flowing through the aperture depends on the following principle. Imagine the hole to be stopped by a very thin plate pierced with a great number of holes, through which the water escapes. Now consider each of these holes as a single insulated aperture, the velocity for each will be according to the correspondent height of the fluid. If the number of holes be infinitely augmented, or which is the same thing, if the plate be removed, the velocity at each point of the given aperture will be as the height corresponding to the same; and in determining the quantity of fluent water, regard must be had to this inequality of velocity.

In treating of the velocity of spouting fluids, I have not noticed friction, which in long tubes considerably lessens the velocity of water.

J. R. C.

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## PATENTS FOR MASSACHUSETTS.

GRANTED IN OCTOBER AND NOVEMBER, 1831.

*October.*

54. For a *cooking stove.* Samuel Beals, Boston, Oct. 1.

55. For a machine for *spinning hemp and flax* and other fibrous substances. Daniel Treadwell, Boston, Oct. 11.

56. For *tubular essence phials.* John Staniford, Boston, October 17.

57. For an improvement in the *book binder's cutting press.* Charles Stimpson, Boston, Oct. 17.

58. For an improvement in making *glass knobs.* Spencer Richards, Cambridge, Oct. 31.

*November.*

59. For a composition to be used in the *stiffening of hats.* Charles Bent and Francis Bush, Chelmsford, Nov. 3.

60. For improvements in the manner of *straightening the toggle joints in the hand printing press.* Otis Tufts, Boston, Nov. 7.

61. For a process for *dying cotton* in the staple, or cotton wool. James Roy Stewart, Lowell—an alien who has resided two years in the United States, Nov. 11.

62. For combined *grist and saw mills.* Noah Sortee, Boston, Nov. 17.

63. For an improvement in the machine for *polishing and graining or dicing morocco*, or other leather, patented on the 20th April, 1831. Robert Emes, Boston, Nov. 21.

64. For an improvement in the mode of *scouring, smoothing, burnishing, &c.* all kinds of tanned skins, or leather. Robert Emes, Boston, Nov. 21.

65. For a *chemical water proof cement* for preserving brick and wood work from the injurious effects of water. Charles Fletcher, Boston, Nov. 22. *Journal Franklin Institute.*

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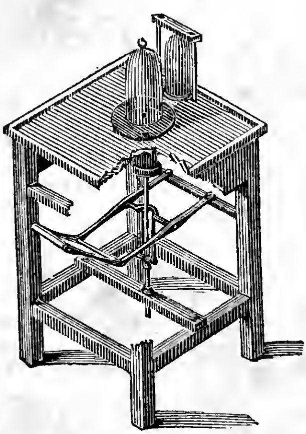
## AIR-PUMP.

MESSRS. EDITORS—I send you the engraving of an air pump, which has been found to answer a good purpose for experimenting before large assemblies. A description of it will be found in the Boston Mechanics Magazine, p. 246. T. C.



This pump may be used either for exhausting or condensing, and besides being useful for all the experiments with common air, may be employed for transferring gases from one vessel to another. This pump consists, first, of a table, or frame-work, made of mahogany, twenty-two inches square, with four legs resting on the floor; its height is several inches above that of the lecture table. In the centre of this table a hole is cut, three inches diameter, for the admission of the pump-barrel, which is two inches internal diameter, and 8 1-2 inches long; a ground brass plate, ten inches diameter, is attached to one end of the barrel; this plate rests on the top of the table, and the barrel projects through the hole before described. The piston is worked by a lever of the second order, having its fulcrum in the back legs of the table. This lever is attached to the piston rod, by two vibrating rods, which assist in preserving the piston and rod in a direct line coincident with the

centre of the barrel. On the table, another ground plate, five inches diameter, is placed by the side of the plate mentioned above; a brass tube passes from this small plate to the pump-barrel, and is inserted just below the valve, which is situated near the top of the barrel; this valve opens downwards. There is another valve in the tube, opening towards the small plate; and the piston is a solid one without a valve.

The mode of operation is as follows:—Place a receiver on the large plate, depress the piston, and the air will pass through by the valve into the barrel; in raising the piston, the air is forced through the tube, and by another valve, when it escapes at the centre of the small plate; so that exhausting is performed by using the large plate, and condensing by using the small one; and no alteration in the pump is necessary, in changing from the one to the other. There is a screw by the side of the large plate to admit the air into the receiver, and another screw by the side of the small plate to let the condensed air escape; one of the valves may be got at by unscrewing a brass piece in the centre of the large plate; the valve is attached to the under side of this brass piece; it is covered with a little cup, to retain the oil and keep the valve moist: the other valve may be repaired by unscrewing the small ground plate. There is a cup screwed to the lower end of the barrel to prevent the oil from running down to the floor.

The opening under the table is for a drawer to contain the small articles used with the pump. It will be necessary to hang a weight of thirty pounds on the cross piece below the pump handle; this will keep the frame very steady. The condensing receiver is held down by screws.

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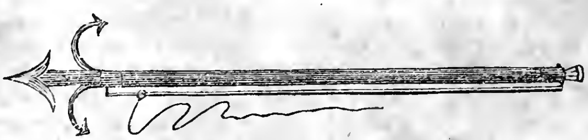

## MURRAY'S INVENTION FOR SAVING FROM SHIPWRECK.

Several ingenious methods have been proposed for effecting a safe communication between the stranded ships and the shore. Mr. Trenghouse suggested a rocket, Captain Dansey a kite, and Captain Manby a shell, for the purpose of carrying out a line to the ship in distress. The plan of Captain Manby was thought so well of at first, that it was honored with a Parliamentary reward, and very great exertions have been made to introduce it into general use. But it has been found attended with so much difficulty, even under the most favorable circumstances, and has in not a few instances failed so decidedly, that it has been only very partially adopted, and has not effected any material diminution in the general loss of life by shipwreck. From the weight of Captain

Manby's apparatus, it is not quickly transportable from the few stations which are provided with it, to the immediate scene of danger; and when the rope is projected it too frequently snaps in two. A transport was wrecked only three miles from Mundesley, where there was one of Captain Manby's safety-mortars, but before it could be conveyed to the spot, the ship had gone to pieces, and all on board perished. In another case, of a ship wrecked off Whitby in 1820, within 60 yards of the shore, the shot, in the first attempt, fell short; the rope, in the second, broke; and the ship and crew were buried in the breakers. On many parts of the coast there is not even this imperfect apparatus of Captain Manby. So late as December, 1830, one of the most frequented, and, at the same time, most dangerous parts of the British coast—that between Plymouth and the Land's End—was so entirely destitute of every sort of means for saving shipwreck mariners, that of the passengers and crews of 28 vessels which went on shore in the dreadful storm of that month, only two men and a boy were saved!

Frequent reflection on these distressing facts has led Mr. John Murray (the popular lecturer on chemistry, and the author of many excellent scientific works) to the invention of the apparatus represented in the prefixed engraving, and described in a pamphlet which we have now before us.* Mr. Murray first tried to project from a common musket an arrow with a line attached to the feather end, but the arrow became *reversed* in its transit through the air, and the following improved and very ingenious arrangement was therefore adopted.

'The figure represents the form of the arrow, as best constructed for the common blunderbuss, and may be propelled immediately from the shore, or carried with the life boat. The butt-end carries a thin metallic shield, or plate, which may be made of copper. The point is sharp and barbed, to fasten where it may trike, or act as a holdfast on the tackling or rigging of the wreck. It is shod with iron, as well to subserve this purpose as to secure its direction, and compete with the resistance it must encounter in a storm. The wood used is hiccory, or ash, or still better, lance wood, the more cohesive the fibre the better; this is withed in its extreme length with whip thread or line; bands or ribbons of thin metal strengthen the arrow, where the bent extremities of the parallel iron rod pass through, and which last are further secured by a shoulder on one side and a nut on the other. Along this parallel rod glances the iron ring to which the line is attached, the instant it leaves the gun, and a bit of cork, or caoutchouc, toward the end of the arrow, interposed between the rod and the body of the arrow, acting as a recoil spring, will so far subdue the effect of friction.

* Invention of an effective and unfailing method for forming an instantaneous communication with the shore in shipwreck; and illuminating the scene in the dark and tempestuous night. By John Murray, F. S. A. &c. 30 pp. 8vo. Whittaker and Co.

'The entire weight of the arrow, thus plumed and shod, is from two to three ounces, eighteen inches long, and three quarters of an inch in diameter. These dimensions and weight have been found more efficient and successful when applied to a blunderbuss sixteen inches long in the barrel, and 1 1-0 inch diameter in the calibre. The entire weight of the arrow and its appendages, together with the strong whipcord attached to it, was two pounds and one ounce, and were carried to an extent of nearly one hundred yards by two drachms of gunpowder. The cord was of sufficient strength to pull a rope from the shore large enough to form a communicating medium of escape from the wreck.

'When applied to a three-pounder swivel, the arrow and its various adjustments weigh together nearly two pounds; and with three ounces of gunpowder a line of considerable strength and power will be propelled upwards of a hundred and fifty yards. In this instance a macharel, or deep sea-line, may be used. The cord is coiled in the form of what is called *French faking*, and was the plan adopted in all our experiments, which seems best adapted to preserve the coils from being entangled—a circumstance of the highest importance in experiments of this description. The barb is removed here to render the appearance less complicated.

'The arrangement is supplied with an appendage for illuminating the flight of the arrow and scene of shipwreck. It consists simply of a cylindrical sheath, or socket, containing the materials of illumination, consisting of a mixture of finely powdered chlorate of potassa and sugar candy, intimately blended together. A spindle supplied externally, with a flat head, enters by its extreme end into a miniature phial supplied with sulphuric acid, sealed with a drop of bees' wax. As soon as the arrow leaves the gun, the reaction of the air on the head of the spindle drives inward the plug of wax and liberates the acid, which instantly kindles the mixture, the brilliant flame immediately fills the globular cage of wire gauze which surmounts it, and the intensity of the light is rendered still more dazzling and splendid by adding a bit of phosphorus to the inflammable powder. This part of the apparatus is made altogether independent of the arrow, and may be easily attached when circumstances require it, as when the darkness of the night renders it imperative. The combustion which forms the source of the illumination, cannot be quenched either by the sea spray or a deluge of rain, the medium of support being supplied from itself, altogether independent of the external atmosphere, however charged with watery vapour or rain, and the combustion is too fierce to be at all affected by the wind, even at its maximum degree of strength.'

The 'experiments' alluded to in the preceding extract are detailed more at length in a subsequent part of the pamphlet, and leave no doubt on our minds, that Mr. Murray's apparatus is by far the most efficient that has yet been devised; while, at the same time, it is so cheap and portable, that inclination alone is all that can be wanting to bring it into universal use.—*Lon. Mec. Mag.*

## RUSSIAN SCHOOL OF ARTS AND TRADES.

The Russian government have just established a seminary of this description at St. Petersburgh, under the title of The Technological Institution. One hundred and thirty-two pupils are to be educated within its walls, at the expense of the state. They are to learn the theory of technicology, the construction of machinery, chemistry, the art of dyeing, &c.; and peculiar advantages are held out to such as distinguish themselves. These latter are to be exempt from the poll-tax and military conscription; are not to be subject to corporal punishment; may take up certain branches of industry without an apprenticeship, and hand down these privileges to their children, who shall be entitled to enjoy them so long as they continue to follow their father's calling. They are to be styled artizans or masters; and independently of the pupils to be educated at the public expense, who are to be chosen from the middling classes, other youths may avail themselves of the Institution, on terms to be prescribed. A sum, equal to £5500, is to be annually appropriated to its support; and gratuitous instruction in the art of design is to be given to the lower orders of mechanics, after morning service on Sundays and holidays. The buildings for this establishment have been erected on the site of what was once a morass in front of Jaegerhof; and two spacious fields, ornamented with rows of wild chesnuts, have been set apart for the scholars' recreations. It was opened on the 23d of October last.—*Quarterly Journal of Education.*

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## NEW APPLICATION OF LITHOGRAPHY.

Col. Peabody and Mr. Dixon, have been conducting a course of experiments in Salem, in order to ascertain the practicability of counterfeiting engraved Bank Notes, by means of an entirely new process of lithography. It has resulted in a conviction that all printing, whether by type or engraving, can be transfered to stone (fifty times or more)—and whereas once so transfered may be multiplied almost without end. The specimens of printing in this way are so perfect that they cannot be distinguished from the originals—and it is of no importance whether the impression were recent or very old. The danger to the community from this discovery that Bank notes and other securities may be easily and perfectly counterfeited, is so evident as not to require illustration. The art however is yet a *secret*—and it is a particularly fortunate circumstance that a process has been discovered by which the copying of such securities by Lithography may be effectually prevented. A patent has been secured for this purpose.

The conclusion arrived at is, that no security to the public is now offered by the use of Perkin's stereotype plates—since a perfect *fac simile* can be made of the Bank notes impressed with his plates by transferring them to stone. So important is this annunciation, that Col. Peabody has thought it best to publish a card, explaining more

particularly the result which he has obtained—in order that the public may not 'prematurely' distrust the present circulating medium. We extract the most important paragraphs:

'The specimens of bank notes which we have already copied, are not perfectly executed; and the reason is, that not being familiar with the manipulations of the lithographer, we have not been able to bring up the work after it was affixed to the stone, so well as we otherwise should have done. Were a skilful workman to undertake the process under our direction, I have little doubt that Bank notes might be perfectly printed by our method. In fact, the mode of proceeding which we have adopted, has been explained to one of our best lithographers, and he is of opinion, that a few experiments would ensure success.

'With regard to Perkin's plate, I am perfectly satisfied that it presents a better safeguard against counterfeiting by engraved plates, than any plate now in use which I have seen. A patent has been secured for a process, which will effectually prevent the copying of monied securities by Lithography; and it was thought best not to publish any thing on the subject, until the Banking Institutions might have an opportunity of satisfying themselves of the value of the security, and adopting it.

FRANCIS PEABODY.'

*May* 26, 1832. *Even. Gaz.*

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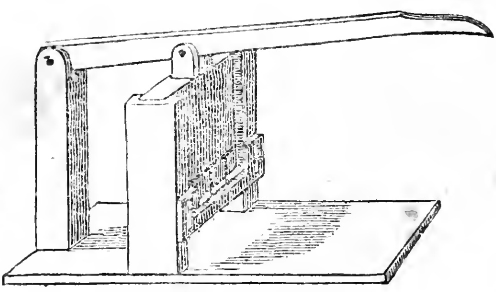

## PRATT'S STABBING PRESS.

In a preceding number of the Mechanic, I observed an article headed Book-Binder's Stabbing Press—invented by the proprietor, John Mead, of Boston. From a perusal of the article, I took the machine to have been recently invented, and as yet but very little in use. While reading the piece and viewing the cut representing the machine, I was peculiarly struck with the resemblance that it bears to one which has been in use in this place for twelve years, and which has all the facilities attached to it which are specified as belonging to the beforementioned machine. The Stabbing Machine to which I allude, was invented by Mr. Simeon Pratt of this city, at a time when he had about 10,000 pamphlets to stitch, and which previously must be stabbed. To

obviate the difficult task of stabbing with a hand awl, as was the usual practice, he set himself to work, and after fixing upon several plans, succeeded in adopting the one we have mentioned, and which by experience has been found to answer every purpose both in making holes for stitching and for strapping.

The difference between the two machines, appears to be very trifling; both are forced with a lever, and work under similar constructions. The awls in the latter are made fast to a slide, which moves upwards and downwards, and which may be set to any distance apart, as the book may require. To the perpendicular pieces in which the slide moves, is attached a horizontal piece of wood, secured by screws, which prevents the book from rising with the awls after being stabbed, and which leaves the book perfectly free. This piece is so made as to be set according to the thickness of the book or books to be stabbed. The utility of these machines in this place have been realized, and the great saving of time appreciated. S. H. COLESWORTHY.

*Portland, May* 8, 1832.

[This machine acts upon the same general principle, as that described on page 62; yet its form of construction and the materials of which it is composed are very different. This is made of wood, whereas Mr. Mead's press is of iron, and takes up less room, on account of the position of the handle.

The only difficulty with the Boston press is with the awls, which require a peculiar temper and some ingenuity in using them. We think there need be no apprehension as to the use of this machine, especially, after twelve years experience in Portland.

This communication shows also very clearly the value of a vehicle like the Young Mechanic, by which improvements in the Arts may be made known.—EDS.]

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## LIST OF SOCIETIES IN BOSTON,

*Whose objects are, entirely or in part, the improvement of the mind.*

Massachusetts Charitable Mechanic Association—Boston Mechanics Institution—Boston Society for the Diffusion of Useful Knowledge—Society of Natural History—Massachusetts State Lyceum—Boston Lyceum—Mechanics Lyceum—Social Lyceum—Young Men's Association for the Promotion of Literature and Science—Boston Debating Society—Franklin Debating Society—Boston Debating and Elocution Society—Speculative Society—Critical Club—Mercantile Library Association—Mechanic Apprentices Library Association.

There may be other societies devoted to similar objects with the preceeding, with which we are not acquainted. If this is the case, we shall be glad to be favored with their names for publication hereafter. There are several Associations for moral and intellectual improvement in the city, the names of which are not made public. Regular courses of lectures are also given during the winter season besides those delivered before the various Associations. We wish to publish a list of the Societies of mechanics

in the country at large, and shall esteem it a favor to be furnished with the names of any that our friends may be acquainted with, together with a brief account of their objects and method of prosecuting them. Accounts of the societies in the city, will be published as we shall have opportunity.

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## NEW PUBLICATION.

First Book of the Fine and Useful Arts, for the use of Schools and Lyceums—compiled by Marshall S. Perry, M. D. Boston, Carter and Hendee. 12mo. pp. 126.

We think a work of this character is called for at the present time. Besides the valuable information it affords to the young student, it is well calculated to incite a deep interest in the study of the fine and useful arts, and thereby to prompt him to the perusal of more elaborate treatises. It also meets the wants of those classes of the community who have not time to read, or are not able to purchase, expensive books on the various arts, as the series will probably furnish all the information that is absolutely necessary in the common walks of life. It seems to be compiled with good judgment; and we do not hesitate to recommend it as affording, at a cheap rate, an amount of knowledge of the arts which every citizen ought to possess. We think the following extract on Lithography will be acceptable to our readers.

'Lithography is the art of printing or taking impressions from stone. It was invented by Alois Senefelder, at Munich, about the year 1796. The father of Senefelder was an actor. It was his intention to have educated his son for the profession of law; but this did not suit his taste; and after his father's death, he attached himself to the theatre, and became an author. He was reduced in his circumstances; and being in search of some cheap way by which he might print his own works, he accidentally made the important discovery of this art. His mother requested him one day to make out a bill for washing clothes, and not having paper at hand, he wrote the list of articles on a stone which he had prepared for the purpose of etching. Some time after, when he was about to erase the writing, the thought occurred to him, that by preparing the stone with aqua-fortis, and applying printers ink to it, it might be possible to take impressions from it as from wood engravings. He tried this and several subsequent experiments, and the result was the art of lithography.

Senefelder at first made his discovery a secret; but in 1799, the King of Bavaria gave him an exclusive privilege to practice his new art for fifteen years, after which he made no exertion to keep a knowledge of it from the world.

The art was introduced into England about the year 1802, and into France in 1807, by M. Andre, a musical composer, who disposed of the secret to all who would purchase it for a given sum. His first attempts, however, at printing, were rather unsuccessful. Count Lasteyrie distinguished himself by his exertions to advance the art. He visited Germany for the purpose of acquiring information, and while there, he engaged a Mr. Engelman to study the

art at Munich; after which, in conjunction with several other gentlemen, he set up a lithographic establishment in Germany. In 1816, Mr. Engelman opened a printing establishment in Paris, where he soon had six presses in operation. The art now assumed a considerable degree of importance, artists of ingenuity turned their attention to it, and daily improvements were made. Lithography was first successfully practised in America by Mr. Wiliam Pendleton, about the year 1824.

The stone used for lithograpic drawing is a sort of calcareous slate, composed of the carbonate of lime with a small portion of iron. The best stone is found in the vicinity of iron mines; it is usually of a bluish white color, and of fine grain.

The best lithographic stones are found at Solenholfen, a village upon the banks of the Danube. The country around abounds with them, and the place derives its greatest importance from this source of traffic. The stones are found at the depth of ten or fifteen feet from the surface of the earth, in horizontal strata of various thicknesses. They can be easily split to the proper thickness, which is about two or three inches. They should be entirely free from veins and crystals. The stone that is found in England, France and America, has not so fine a grain as that found in Germany, and therefore is inferior.

The stones are prepared for drawing by having their surfaces made smooth and uniform. The lines are drawn by the artist with a composition made of tallow, wax, shell-lac, common soap, and lamp-black, the usual proportion of which are—tallow, 2 oz.; shell-lac, 1 oz.; soap, 1½ oz.; and lamp-black, 1¼ oz. This composition, when undiluted, is formed into small rolls, and receives the name of crayon or graphic chalk. When diluted with water it is called lithographic ink, and in this form it is applied to the stone by means of steel pens or camel's hair pencils.

Drawings executed with the pen, are much the most durable, and many more impressions can be taken from them, than from those executed by means of the chalk.

It requires a good deal of skill in an artist to make a fine drawing on stone. The subject may be traced on the stone with red chalk or a lead pencil, but it must be done very lightly. When drawing, the artist must vary the pressure of the hand according to the tints which he wishes to obtain; or he may obtain any gradation of tint by varying the thickness of the lines or the distance at which they are placed from each other. A scraper is used to erase all errors and to procure lights.

When a drawing is finished, it is carried to the printer, who pours upon the stone diluted nitric acid, which produces a chemical change upon its surface, and discharges the alkali of the soap, which enters into the composition of the crayon and ink. This process is called etching. The stone is then covered with a solution of gum arabic, which fills up the pores, and prevents the ink from spreading. Previous to printing, the stone is wet with water, which is absorbed by every part of it except that which has been touched by the composition, for grease will not unite with water, while all calcareous stones possess the property of imbibing fluids, except they

be protected by oily substances. A roller is now charged with printing ink, and being made to pass over the stone, the ink readily adheres to the greasy lines of the drawing, but does not to those parts covered with water. The impressions are obtained in the same way as those from engravings. After each impression, it is necessary to wet the stone and apply the roller charged with ink.

It will be seen that the process of obtaining prints by lithographic engravings, is much less mechanical than any other mode, for it is founded upon a judicious application of chemical principles. The printer's ink being oily, readily unites with the oily composition which has been applied to the stone in drawing, while neither will unite with the water. These are the general principles upon which the art is founded. The number of impressions which can be taken from one lithographic drawing, when executed with the crayon, may vary from 500 to 1500, according to the fineness of the tints.

The art of lithography possesses many advantages over that of engraving. An engraving must be a copy, but a drawing on stone may receive many fine touches from the hand and skill of the artist. An impression from a copperplate can be transferred to stone by pressure, and then be printed in the same manner as if it had been originally drawn on the stone. The process of transferring an engraving to stone is extremely simple. The engraving must be laid with its surface upon water, until it becomes thoroughly wet, when it is taken and applied to the surface of the stone, which has been prepared in the usual manner. An equal pressure is now made by means of a roller, till the ink leaves the paper and adheres to the stone. The cheapness of lithographic prints brings them within the reach of all classes of society, and the works of authors which require embellishment, are by this art reduced in price.'

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## ANSWERS.

Messrs. Editors—In a former number of your valuable and promising journal, I noticed a question asked by 'a master mechanic.' I would make a few remarks in reply, rather for the purpose of drawing the attention of other mechanics to the subject, than to propose any measures or a fixed plan by which the relations subsisting between masters and apprentices may be made mutually beneficial.

The subject is one of great importance, and well worthy the attention of all engaged in the arts.

In fixing upon a plan or articles of agreement between the mechanic and his apprentice, many things are to be considered, in order to protect the first from the non-fulfilment of his just claims upon the time of his apprentice, and to prevent the oppressive exercise of the power in the hands of the former over the latter. For this purpose it will appear evident, that the whole power ought not to be vested in the hands of the master, but rather that in case of difficulty occurring between them, a disinterested individual, or an association of individuals, should decide upon the proper claims of the parties concerned. To exemplify the

necessity of having some disinterested, or rather impartial association to appeal to, to whose decision both parties should be bound to accede, I would here notice one instance of not unfrequent occurrence. A boy at an early age is bound by his parent or guardian to remain until he is twenty-one years of age with a mechanic, for the purpose of learning a specified trade, without being consulted as to his inclination or taste for the trade he is to learn; or if he be consulted, he may not have acquired a taste for any particular one, or he may be deceived, and find after a few-months' practice that he has not a taste for, or is incompetent to learn an art of his own selection. In a case of this kind the master may think it for his advantage to retain him in his employ to do the drudgery of the workshop, or menial offices unconnected with the trade it was intended he should learn. In either case the consequences ensuing would be in the highest degree injurious to the boy, and in the one before mentioned they would also be so to the master. In the former case more time and attention, and in many trades a greater loss of material, is required on the part of the master, while the latter years of his apprentice's time are less valuable to him, and on the part of the apprentice the best portion of his life is spent in acquiring a practical knowledge of his business, and the name of a *blundering workman.* I have given this example merely to show the injurious consequences resulting from the power of a selfish and unprincipled master over his apprentice; but were there no obligations by which the apprentice might be controlled, it is evident that the master might be the sufferer. But this is but one objection to binding an apprentice to a trade at an early age in the usual manner. Another equally strong is, that no provision is made for the intellectual and moral improvement of the boy. An apprentice may obtain much valuable information during his apprenticeship without neglecting his employer's work; for there are few occupations in which he may not be occasionally spared an hour or two from his labor, without interfering with or neglecting the duties of the workshop. In some manufactories and workshops an abundance of leisure is afforded, after the work of the day is ended, for mental cultivation; but in many, when the evenings are occupied by labor, little leisure is afforded except on Saturday evening and Sunday, the former of which is generally required for rest, and the latter occupied by attendance at church.

The great obstacle, therefore, that the apprentice has to encounter in his endeavor to obtain knowledge, is want of time. True there are none who might not devote an hour daily to this purpose, however closely their time may be required by their occupation; but it is to be remembered that when the body has become wearied by ten or twelve hours' labor, it requires a strong incentive to fix the mind upon any subject requiring close examination; and that the *rudiments* of science do not possess that incentive. The interest of the student is not awakened, his mind is not excited be the dry investigation of the elementary principles of the subject he pursues. It is necessary that he should overcome the first obstacles that present themselves, and acquire sufficient information to enable him to understand the general principles of the subject he investigates; and then the interest which is excited in him will enable him to overcome many difficulties, which to the young mind, in its first efforts, would have proved insurmountable obstacles.

The importance of scientific information to that class, above all others to whom these remarks are addressed, it is unnecessary to comment upon here. All must feel sensible of the advantages that are to be derived by the master, the apprentice and the world at large, by offering encouragement to young mechanics to obtain a theoretical knowledge of the business in which they are engaged, both as regards their standing in society and the greater perfection of the products of their labor, and also as affording them a rational means of enjoyment, which,

after all, is the one great object toward which all our efforts are directed. This encouragment it is in the power of all, and it should be felt as a duty binding upon all our master mechanics, to offer to those whose time is placed at their disposal. A premium to attend the lectures which are now so bountifully opened to us in our city, together with an occasional evening for reading and experimenting, is all that is necessary on their part to produce so great an amount of good. J. H. B.

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The four weights which would be required to weigh from 1 to 40 pounds with the common scales are, 1 of 1 pound—1 of 3 pounds—1 of 9 pounds—1 of 27 pounds. N. E. J.

The rule is, to multiply each weight by 3 for the next above it, commencing with 1. EDS.

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In answer to the question in the last number of the Young Mechanic respecting the cider, I reply—1-3 as much cider will remain as the Barrel will hold, or 6 2-3 gallons of cider, and 13 1-3 gallons of water. D.

The following formula has been handed to us, but it gives a different answer from the above; and as both are without a demonstration, we cannot vouch for the correctness of either. EDS.

Calling the original quantity of cider $= a$, and the number of operations of drawing out and putting in water $= n$, the quantity of cider remaining after any number, $n$, of operation, will be

$\frac{a2 - a}{a + n - 1}$. Which will give nearly 39·75 pints, or about 5 gallons.

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## QUESTIONS.

Messrs. Editors—Being desirous of obtaining correct scientific and practical knowledge relating to the Mechanic Arts, I send you a short communication, in the hope that some enlightened and scientific mechanic will give some information concerning a process very common in various manufactures—that of rendering steel or iron of a beautiful blue color. The process is very simple, and perhaps so well understood by most mechanics, that they will not give it a moment's consideration; but I should like to be informed, what is the best method of producing an equally beautiful and permanent blue upon polished steel or iron, and also obtain a satisfactory answer to some questions that I shall ask relating to the process. In the first place, I will state that I attempted to produce a blue upon some small pieces of sheet iron, in which I was successful; but on applying a clean brush or the finger, the color was immediately rubbed off, leaving the surface as clean and bright as before. The operation was several times repeated with the same results. It is proper perhaps to state, that the surface of the iron was made smooth and burnished before bluing. Then why, in the above process, was the color so easily rubbed off? and what is it, in the composition of iron, that appears of such an elegant blue color when a certain degree of heat is applied, and which will appear from the same piece as often as made bright and heated? GULIELMUS.

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Permit me through the medium of your publication, to ask some of your correspondents if they are acquainted with any composition, or oil paint, which will serve to put on large castings of iron, without their being heated, and when dry, to have the smoothness and appearance of japaned articles? A SUBSCRIBER.

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Erratum.—Page 66, line 23d from the top, for *from* read *form*.

THE

# YOUNG MECHANIC.

VOL. I. JULY, 1832. No. VII.

## OBSERVATIONS ON DRAWING INSTRUMENTS.

[Continued from p. 82.]

### THE DRAWING COMPASSES.

COMPASSES are made either of silver or brass, the points being always of steel. The joints should always be formed of different metals ; thus one side or part should be of silver or brass, and the other of steel: the opposition in the texture and porous qualities of the two substances, causes the parts to adhere less together, to wear more equally, and to be uniform in their motions. The accuracy of the measurements is ascertained by the smoothness and equality of motion at the joints, for all shake and irregularity denotes an imperfect instrument. The points should be of steel, well hardened and tempered, else in taking measures from the scales they will soon become blunted or bent—not too fine and tapering, yet meeting very closely when the compasses are shut. They also should be well polished, whereby they may be preserved from rust a long time. As an instrument in *general* use, the compasses are so well known, that it would be superfluous to enumerate and explain their various uses. Suffice it to say, they are used to transfer measures of distances from one place to another, and to describe large and small arcs of circles. If the arc or circle is to be described obscurely, it should be done by the steel points ; if it is to be in ink, crayon or black lead, the pen and pencil points are to be used.

*To use the Compasses.*—Beginners at first are apt to use a pair of compasses in a very awkward manner, whether in transferring distances or in describing circles; but practice will soon render them sufficiently familiar. With the thumb and middle finger pinch the compasses in the opposite hollows of the shanks, causing them to open a little: this being done, apply the third finger to the inside of the innermost leg, and with the nail of the middle finger acting against the farthest, open the compasses sufficiently to introduce the fingers between the legs. They may then be extended to any distance at pleasure, by moving the farther leg forward

and backwards with the middle and fore fingers. In this manner the compasses may be entirely managed with one hand, always observing never to work them with both hands at once, because they are apt in this way to indent or slip on the scales, thereby scratching and defacing the divisions. The compasses should always be held in an upright position, or inclined in a very small degree from one, and great care is necessary to hold them very lightly, merely allowing them to act by their own weight ; and the legs had better be never so far extended as to make an angle with each other of more than 160°. In describing circles with the compasses, one foot must be set on the point designed as a centre, (being very careful not to press upon the paper with more weight than that of the compasses,) holding the head between the thumb and middle finger; then, rolling the compasses round, at the same time allowing the other point to rest upon the paper, the circle may be described with perfect ease, either in ink or pencil. The ink and pencil points have a joint in their tops, which fits into the compasses, and is confined by a screw, but the end of the shank of the best compasses is formed into a socket, which receives the pencil or pen point, and acting upon it with a strong spring prevents all shaking. This is found to be much better than the former method of a screw. Compasses are sometimes formed with the addition of a clamp and adjusting screw. This consists of a piece of steel which is formed to a screw at one end, the other having a slit or opening in it for the reception of the clamping screw, with a milled head, which screws into the leg of the compasses and binds the steel fast against it. A milled head nut plays upon the screw at the opposite end. This nut has a shoulder and a neck, or small part which is fitted and turns in a socket formed of a rectangular piece of brass, fastened to the other leg of the compasses by a round pin which passes through the leg, being secured on the opposite side by a nut or screw which prevents it from either drawing out or shaking, though allowing it at the same time to turn very freely. The utility of this contrivance is very great for measuring accurately, or dividing lines or circles into a great number of parts. By turning the nut, a very slow, delicate and progressive motion is given to the leg of the compasses. For ordinary purposes this apparatus may be removed altogether, but when extreme accuracy is required this becomes a very useful and beautiful instrument, and is decidedly the best which has been invented.

*The Spring Dividers*, are a small instrument for setting off a great number of small equal divisions, being not liable to alter while in use. They have no joint, but are composed of one solid piece of steel, and always tend to open by their own elasticity. They are closed and adjusted by a small screw, which passes through one leg and is tapped into the other. The tops of the legs are sometimes formed very similar to the top of the blades of the steel drawing pen, and screws into a brass cap.

There are likewise what are called *Hair Compasses*.—They consist of a pair of common dividers, the steel part of one of the legs

being secured to the shank by a long spring, which is confined at the end by a screw. This spring always has a tendency to throw the point inwards, and is counteracted by a screw with a milled head, passing through a hole in the end of the shank and tapped into the spring of the leg. To use these compasses, they must be held in the right hand, the screw being turned towards the left: by turning the screw with the thumb and fore finger, the spring point is brought nearer or farther from the other point. A great objection to these compasses is, that the leg, depending so much upon the stiffness of the spring to which it is attached, is apt to yield very materially, when pressed upon the paper, and serves better in theory than in practice.

*The Bow Compasses*, on account of their size, are used to draw very small arcs and circles, which can be done much more conveniently than by the large compasses, as from the peculiar shape of the head, it rolls with great ease between the fingers. Many improvements have been made in this little instrument as well as in the others, but the best, and probably the most convenient kind, have solid shanks, which meet at one end in a joint which is connected to a handle; the other end of the shanks having sockets into which the plain point and the ink and pencil points may be fitted and fastened by a screw. A duplicate leg is sometimes provided for this instrument, by which it may be converted into a *road pen*, which will draw double lines at any required distance asunder, and is much used for drawing roads on maps, plans, &c.

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## CHEMISTRY.

[Continued from page 21.]

### CALORIC.

One of the most obvious and familiar effects of caloric is, that it has a tendency to expand all substances; i. e. heat any substance, and it is expanded, and occupies a larger space, cool it and it is contracted, and occupies a less *space*. There are one or two exceptions to this very general principle, which will be noticed hereafter.

9. We might take as a proposition, therefore, that all substances are expanded by being heated. We cannot, of course, illustrate this to the fullest extent, because, to do it, we should have to refer to the effects which caloric would produce upon all substances. We may select substances, therefore, from the three large classes of natural substances, i. e. solids, liquids and aeriform bodies, and show that these are expanded by being heated.

10. First, air is expanded by being heated.

Illustration. Apply anything that is hot to the bulb of the air thermometer (which has been explained.) It will drive the liquid down, showing that the warmth expands the air in it.

This principle is applicable to many of the common phenomena of nature. It is owing to this fact, probably, that we have any

motion of the atmosphere; i. e. the blowing of the wind, also the cause of the ascent of smoke, &c. up a chimney or stove pipe. For as the air is heated and expanded, it is measure for measure rendered lighter; so that the cold surrounding air presses it up.

When a fire is built, the air over it is heated—becomes lighter, and the cold air in the room presses it upward; *that* in its turn is also heated, and thus a continued current is kept up, carrying with it the smoke.

11. That liquids are expanded, may be seen by filling a bolthead or florence flask with water; having the water fill about one inch of the neck. Heat it, and the water will be expanded and rise in the neck.

Common thermometers are constructed on this principle, and as an application of the fact here illustrated, we may refer to the method of filling and graduating these instruments. A thermometer is a glass tube having a bulb blown on one end of it, the bulb and a portion of the neck being filled with some liquid. (See plate on p. 78.) The *caliber* of the tube being so small that they cannot be filled by turning the liquid through it into the large part, the following method is adopted for this purpose.

The thermometer is in the first place heated, and the air being thus expanded, much of it is driven out; while thus hot, the open end is placed in the liquid with which we wish it filled; (mercury is generally used,* but to illustrate the principle any colored liquid will answer.) As the thermometer cools, the air in it will be condensed, and the pressure of the surrounding air, on the surface of the liquid in the vessel in which the thermometer is placed, will force it up the tube, and nearly fill it.

When cold, remove it and again heat it in the same way, and by so doing two or three times, it may be obtained entirely full.

The whole of it is then exposed to as high a temperature as the thermometer is ever calculated to indicate when finished. The liquid will of course be expanded and rise in the tube; a mark is made on the glass where it stands. The glass is then melted a little above this mark, and moulded together while hot, so as to make it perfectly tight. This is called hermetically sealing it.

It is then graduated, so as to indicate temperature, by the following method.

The boiling, and freezing, of water, are assumed as starting points.

The thermometer is put in water, freezing cold. The liquid in it will be condensed and pass down the tube. Wherever the

* Although Mercury is generally used in the construction of thermometers, yet it cannot be used to denote temperatures ranging under 42 degrees below zero; for at that temperature, the mercury freezes into a solid mass. In the arctic regions, which Captain Parry visited in 1820, his thermometers, which were made of mercury, froze and became useless. But, by using those made of alcohol, he was enabled to describe with accuracy the intense cold which prevailed in that region. If alcohol freezes at any temperature, it is so many degrees below that of any other fluid known, that it is well adapted to the construction of thermometers which are required to indicate more intense cold than mercury will admit. EDS.

liquid stands make a mark, either on the glass, or the frame on which it is fastened. Then put it in water boiling hot; the liquid will be expanded, and ascend in the tube; wherever it stands make another mark. Then divide the space on the tube, between these two marks, into an equal number of degrees, and extend degrees, of the same length, above and below these marks: and we shall at once perceive, that these will be the properties of this instrument. Whenever it is exposed to a temperature, just as cold as at which water will freeze, the liquid in it will be just as much condensed, as it was when put in the freezing water in the first place; and whenever exposed to a temperature, just as high as at which water will boil, it will be just as much expanded, and the liquid in the tube will stand at the same place; and so on with any intermediate temperature, above or below these marks.

12. That solids are expanded, by being heated, may be seen, by taking the measure of a metallic rod when cold, heat it and we shall find it longer.

Illustration ii. This fact is illustrated more plainly, by using a pyrometer; which is a machine so constructed, by means of a multiplying power, that a slight expansion of a bar of metal, or any other substance, may be seen on a large scale.

Place a rod in the pyrometer, and apply heat to it; it will cause the index to move over a large surface.

It is owing to this principle, that it is so extremely difficult to obtain clocks and watches that shall keep correct time; for when heated the different parts are expanded, and move slower—will lose time: when colder will be contracted—move quicker, and of course gain time.

13. Caloric tends to an equilibrium, i. e passes from one body if hot, to all other bodies in the vicinity, till they are of the same temperature.

We may see this in part illustrated, by putting the hand upon the bulb of the air thermometer. At first the liquid will descend, but soon become stationary. The hand being warmer than the air within the thermometer, caloric passes from the hand to the air, warms and expands it, until that becomes of the same temperature. All bodies similarly situated for any considerable length of time, will be of the same temperature.

14. Bodies have the property of conducting caloric, or allowing it to pass through their substance. Different substances possess this property, however, in very different degrees.

Illustration. This may be illustrated by taking small cones of different substances, a few inches long, and putting a little wax or phosphorus on the apex, set them on a heated metallic plate. The wax will be melted, or the phosphorus inflamed, from some much quicker than from others. It may also be illustrated, by the conductometer, which is a small tin vessel, about two inches in height, having a number of tubes in the top of it. Fill this with hot water, and place in these tubes rods of different metals, glass, pipe-clay, wood, &c. having the wax or phosphorus on the upper

end as before. The difference in time, in which they will be effected, will show the different conducting powers of the substances.

All metallic substances are good conductors, though some are better than others. Silver, gold, and copper, are better conductors than platinum, iron, and lead. Wood, charcoal, wool, silk, feathers, down, fur, &c. are poor conductors. This principle has a wide application in domestic economy.

15. Caloric is reflected from hard polished surfaces like light.

Illustration. This may best be illustrated, by using two concave mirrors, of planished tin or plated copper, placed at the distance of about eight feet. Under these circumstances, when a thermometer is in the focus of one of the mirrors, it will be found to be effected by a heated body placed in the focus of the other: and that it is produced by reflection, and not radiation, may be shown by moving the thermometer out of the focus, towards the heated body, or by hanging a small screen between the thermometer and heated substance; in neither of which cases will the thermometer be effected.

Having a ball two inches in diameter, heated red hot, in the focus of one, place a lamp so that the wick shall be in the focus of the other. A small piece of phosphorus, placed in the wick, will be inflamed and light the lamp.

16. When liquids are changed into aeriform bodies, they are immensely expanded.

Illustration. This may be illustrated in a very amusing way, by using an *eolipile*, which is a globular piece of metal or glass, having a long slim neck. It may be used by the following method. First heat it and expand the air: then hold the stem in cold ether or alcohol: as the air is condensed the liquid will be forced into it. Then hold the ball over a lamp and cause the liquid to boil: as it is changed from the liquid to the aeriform state, it will be expanded and forced through the tube with great velocity; which may be seen by applying a blaze to the vapor; it will burn brilliantly. By causing it to boil rapidly, a stream of blaze many feet long will be produced.

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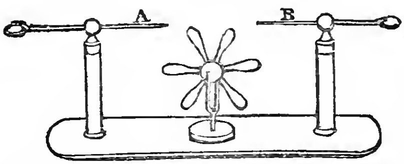
## MECHANICAL EFFECT OF ELECTRICITY.

The mechanical effects of electricity are exhibited in its power of impelling and dispersing light bodies; of perforating, expanding, compressing, tearing, and breaking to pieces, all conducting substances through which it is sufficiently powerful to force its passage.

If a light wheel, having its vanes made of card paper, be made to turn freely upon a centre, it will be put in motion when it is presented to an electrified point. The wheel will always move from the electrified point, whether its electricity is positive or negative. In this experiment the current seems to be produced by the recession of the similarly electrified air in contact with the

point, and therefore the circumstance of the wheel turning in the same direction when the electricity is negative, cannot, as Mr. Singer has remarked, be considered as any proof of the existence of a double current of the electric fluid. As an illustration take the following experiment:

Place upon an insulating stem a light wheel of card paper, properly suspended upon pivots, as represented in our plate, and introduce it between the pointed wires (A B) of the universal discharger, placed exactly opposite to each other, and at the distance of little more than an inch from the upper vanes. Then having connected the wire A with the positive conductor, and the wire B with the negative conductor, of an electrical machine, the little wheel will revolve in the direction A B; and if the wire B is connected with the positive end, and A with the negative end, the motion of the wheel will be from B to A. The transmission of a small charge through the wires, by an insulated jar, will produce the same effect.




The preceding experiment, imagined by Mr. Singer, is considered by him as a proof that there is only one electric fluid, and that it passes from the positive to the negative wire; for, if there were two electric fluids he concludes 'that the wheel being equally acted upon by each, will obey neither, and remain stationary.'

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## ON CURING DAMP WALLS.

Messrs. Editors—I have often looked with pleasure at the beautiful statue of Washington, which has excited considerable interest in our community, and is deservedly considered as an elegant specimen of the fine arts, as well as a tribute of gratitude to this father of our country. But, whatever feelings of respect and enthusiasm would arise while looking at the noble form before us, we cannot fail of having those feelings checked, by the disagreeable appearance around it.

I would not have it thought, that the fault is in the form of building, or any thing connected with the architectural department, as these appear both appropriate and in good taste. But the cause of complaint is, the painted walls upon the inside. These having been painted while the plaster was in a damp state, the lime acted upon the paint, and changed the color in spots. This not being the only case where I have observed this difficulty, I am induced to invite the attention of mechanics to this subject, for the benefit of those who, by closing a window, or making other alterations in a room, are subjected to a similar inconvenience, either from the dampness preventing the paper from sticking, or discoloring the paint.

Two methods practiced in England, and published in the London Mechanics Magazine, I think can be criticised with propriety. The first of these is, covering the walls with thin sheet lead which is prepared for the purpose, and fastened with small copper nails. This method might possibly answer for a private dwelling, but it is well known, that for a public building like the State House, it would be an actual temptation to destroy the face of the wall entirely. I hardly need recal the minds of your readers to that peculiar characteristic of the New Englanders, which, amidst all the improvements that have grown up around it, still retains its existence. I allude to the practice of cutting, scratching, &c. in public places. This propensity is really carried to such an extent, that if a foreigner, unacquainted with our habits, *had* seen the carving of the wood work of the State House cupola, and was *now* to see the figures, letters, and names, cut on the copper (with which the state was obliged to sheath the inside, to prevent its being cut entirely away,) he must certainly be convinced, that the Yankees ought to be celebrated, for being such adepts in the *classical arts* of *engraving* and *sculptor.* Considering the method of leading in this light, as applied to the building in question, I feel assured, that the majority will agree with me in deciding, that it would be entirely useless.

The second method is, to wash the walls with water slightly impregnated with sulphuric acid, which I should think to be liable to more than one objection. The object of this wash is to neutralize the alkaline or caustic qualities of the lime, to prevent its acting on the oil in the paint, and producing the effect complained of. The important objections which I conceive against this method are, first, the alkaline, or principal property of the lime being destroyed, it would have a tendency to leave the walls in a crumbling and weak state. Secondly, however smooth the walls might be after having been plastered, the acid, acting upon the lime, and not the sand which is mixed with it, would leave the surface in a very uneven and rough condition, and thus remedy one evil and produce a greater. My object in this communication is, to learn if there is any simple but effectual method for preparing walls such as I have mentioned, for painting or papering.

J. M. W.

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### METALLIC CASTS FROM ENGRAVINGS ON COPPER.

A most important discovery has lately been made, which promises to be of considerable utility in the fine arts: some very beautiful specimens of metallic plates, of a peculiar composition, have lately appeared, under the name of "cast engravings." This invention consists in taking moulds from every kind of engravings, withline, mezzotinto, or aquatinta, and pouring on this mould an alloy, in a state of fusion, capable of taking the finest impression. The obvious utility of this invention, as applicable to engravings

which meet with a ready sale, and of which great numbers are required, will be incalculable; as it will wholly prevent the expense of retracing, which forms so prominent a charge in all works of an extended sale. No sooner is one cast worn out, than another may be immediately procured from the original plate, so that every impression will be a proof. Thus, the works of our most celebrated artists may be handed down, *ad infinitum*, for the improvement and delight of future ages, and will afford at the same time, the greatest satisfaction to every lover of the fine arts.

*Operative Mechanic.*

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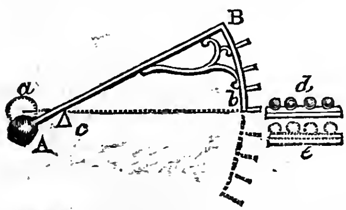
## SIMPLE MACHINES.

The following extract is from Arnott's Natural Philosophy. We would recommend to Mechanics an attentive perusal of the illustrations and conclusions drawn from it, and assure them that they cannot be too well grounded in first principles.—EDS.

ANOTHER case of the lever, exhibited in the adjoining diagram, serves well to explain the nature of *mechanical powers* in general. Suppose A to be a weight of four pounds at the end of the rod of lever A B, turning on C as an axis or fulcrum, and having the arm C B four times as long as the arm C A: one pound at the end B, would balance the four pounds at the end A,· and the slightest additional weight would cause it to preponderate. Now let us suppose the arc B *b* fixed to the long arm of the lever, and having four projections or shelves from it, on which balls of one pound might rest: if one of the four balls from the plane *d* were to roll upon the first shelf, with one grain more, it would lift A, and would itself descend to the plane *e*, one inch below;* then a second ball of one pound would occupy the second shelf, and would descend in the same way, and then a third, and then the fourth; and when the whole had fallen from *d* to *e*, they would just have lifted the four pounds weight, at the other end of the lever, one inch. Then, although one pound were seen here lifting four pounds, it would only have lifted it one-fourth part as far as it fell itself, and the sum of the phenomenon when ended would be, that four pounds, by falling one inch at the long end of the lever, would have lifted four pounds one inch at the short end. No *mechanical power* or *machine* generates force more than the lever in this case.




It appears, then, from all this, that as the *quantity of motion* in a

* The ball must be supposed here to roll off.

body is measured by its velocity, and the number of atoms in it conjointly, so the *quantity of force* exerted in any case, is measured by the *intensity* of the force conjointly with the *space* through which it moves; and therefore a clear mode of speaking of forces in comparing them is to state the *length* and the *intensities*—for instance, to speak of ten feet of one pound force, or of one foot of ten pound force.

A horse pulling with a force of fifty pounds goes generally at the rate of six miles an hour:—the steam engine piston generally moves at the rate of two hundred feet per minute, and has a pressure of steam of about twenty pounds to each square inch of its surface:—a certain mill-stream may have a force of one hundred pounds, and a velocity of a hundred and fifty feet per minute. Now it is easy, by simple arithmetic, and the rule of *length* and *intensity* above explained, to compare all these and other forces as applicable to any work. We must warn the reader, however, that there are many important considerations connected with the practical employment of forces, according to their respective nature, and that of the resistance to be overcome, which cannot be entered upon in this elementary work. In very many cases there is a great waste or unavoidable loss of force, because the resistance in yielding, runs away or escapes from the force, as when a ship runs away from the wind which is driving her, or the floats of a quick moving water-wheel from the stream which turns it. Horses drawing boats or carriages at the rate of five miles an hour, may exert great force, but with a speed beyond twelve miles, nearly their whole effort is required to move their own bodies. As a general rule, although *equal quantities* of force balance each other when applied to parts of a lever or wheel altogether or nearly at rest, still when force is made to act near an axis or fulcrum, to produce considerable velocity in a more distant part, much of it is wasted in pressure against the fixed fulcrum.

What an infinity of vain schemes—some of them displaying great ingenuity—for perpetual motions, and new mechanical engines of power, &c. would have been checked at once, had the great truth been generally understood, that no form or combination of machinery ever did or ever can increase, in the slightest degree, the quantity of power applied. Ignorance of this is the hinge on which most of the dreams of mechanical projectors have turned. No year passes, even now, in which many patents are not taken out for such supposed discoveries; and the deluded individuals, after selling perhaps even their household goods to obtain the means of securing the supposed advantages, often sink in despair, when their attempts, instead of bringing riches and happiness to their families, end in disappointment and utter ruin. The frequency and eagerness and obstinacy with which even talented individuals, owing to their imperfect knowledge of this part of natural philosophy, have engaged in such undertakings, is a remarkable phenomenon in human nature. Examples of such schemes will be noticed in different parts of this work, where they may serve to illustrate points under consideration.

## BENJAMIN HENRY LA TROBE.

It is with real regret we announce the death of a very amiable man and skilful artist, a native of this country, (Eng.) who has successfully exemplified his talents as an architect and engineer in the United States of America ; and whose reputation has deservedly obtained an elevated rank abroad, and a corresponding respect at home.

The New Orleans papers to the 4th of September, describe the ravages of the disease by which that city is afflicted as being awful and increasing, and announce, that among the victims to its violence is B. H. La Trobe, the distinguished artist, who is well known from his works by nearly all the Atlantic states ; he died on the 3d of September 1820. Two or three years ago, his eldest son fell a victim to the climate of the same place. In 1795, Mr. La Trobe, at the age of 33, visited America with the purpose of proceeding to Philadelphia, and to the seat of his maternal uncle, Colonel Antes, on the Susquehanna ; but from severe stress of weather, in which the ship was in much danger for ten weeks, it ran into Norfolk, in Virginia. Here, unknown to every one, he accidentally accosted a gentleman who proved to be a commissioner of the customs, and who, interested by his amiable manners, invited him to his house, and shortly introduced him to Col. Bushrod Washington. This gentleman, interested by the superior accomplishments of the young stranger, took a speedy opportunity to present him to his relation, the President, with whom he remained some days at Mount Vernon, and was encouraged to enter upon his profession as Architect and Engineer.

In this little history of events, how much is obviously the work of a kind Providence, who, from the very elements of human anxiety, disappointment and danger, causes the fulfilment of our most arduous enterprises, and, as it were, in a moment, effects events, whose distance is beyond the command of men, even by the exercise of the greatest skill and most laborious exertions.

Mr. La Trobe was early consulted on the practicability of making James River navigable, which he accomplished, and was appointed Engineer to the state of Virginia. He resided some time in Richmond, and a few years at Philadelphia. He executed important works for supplying the city with water, and built the Bank. He also repaired and improved the works of defence and the light houses on the coast, and thus obtained the appointment of Engineer to the city of Philadelphia.

About this time, being a widower, he married an amiable and accomplished lady, the daughter of Isaac Harkhurt, Esq.

On being appointed surveyor of the public works to the United States, he removed to Washington ; and there executed some of his principal undertakings, among which is the Hall of Representatives. It is a circumstance worthy of remark, that but one month prior to the time of his decease, Mr. La Trobe addressed a letter to Mr.

Ackerman in which he enumerates some of his chief works, and consults him on the publication of his designs, copies of which he intended to transmit to London for the purpose. He mentions the following :

The Cathredral of Baltimore, a building of Granite, vaulted throughout, and the largest church in North America ; the dome 70 feet internal diameter, and 100 feet internal height. the Exchange of Baltimore, 256 by 140 feet, as his boldest work—the dome 115 feet high. The Hall of Representatives at Washington, a room 100 feet long by 80 feet wide, 50 feet high, and embellished by twenty-four highly sculptured Corinthian columns, 28 feet high, and with a suitable entablature, all of stone, and the whole vaulted in that material and brick.

The Bank of Pennsylvania, a building entirely of white marble, some of the covering blocks of which are 25 feet long, 5 feet wide, and 1 foot thick. This he considers his best work.

The Engine House of Philadelphia, in the centre of the principal square, for the supply of water to that city he states, is of marble, and decorated with columns 16 feet high, in single blocks.

The north wing of the Capitol of the United States he maintains as having been begun when he became surveyor of the public works ; and that he succeeded a French Architect, and our intelligent countryman, Mr. Hatfield, the architect, in building. As part of this edifice was of a temporary nature, he reformed the interior and simplified the exterior, designed the centre, and erected the south wing in correspondence with the north. The interior, however, he regrets as not being to his mind, and concludes by stating *la difficulto varnuce* is yet too conspicuous in its arrangements. Mr. La Trobe adds, that the Bank of the United States, now building by one of his pupils, Mr. Strickland, is his design, but that the principal room is a deviation from it.

Mr. La Trobe's occupation towards the close of his life, became of a very anxious nature ; and, as a portion of his letter to Mr. Ackerman not only explains it, but supplies a just encomium on his eldest son, whose death was noticed in the commencement of this narrative, we shall take leave to extract it.

'In the year 1811, I sent my eldest son, then only 17 years old, to New Orleans to attend to the execution of the works necessary to supply the city with water, for which object I had obtained an exclusive privilege. I was surveyor of all the public buildings of the United States, an office of great trust. My son, with uncommon talents, and particularly for the object of my own profession, with the assistance of good mechanics, was able to attend to this great work. The war and a variety of other causes delayed the execution of the work, and in 1817 I had the irreparable misfortune to lose him, leaving the concern and $50,000 involved in it, in the most precarious state. It was therefore necessary for me either to submit to a total loss of so large a property, or prepare to come to New Orleans. I resigned therefore my public office, and in 1818 came hither ; and on April 20th, brought my whole family, where we shall probably reside for a year or two.'

On the 4th, of August, Mr. La Trobe wrote the preceding letter, and on the 3d of September following he was no more.

As the biography of men of genius is at all times interesting, we add some facts relative to the early years of our much lamented friend.

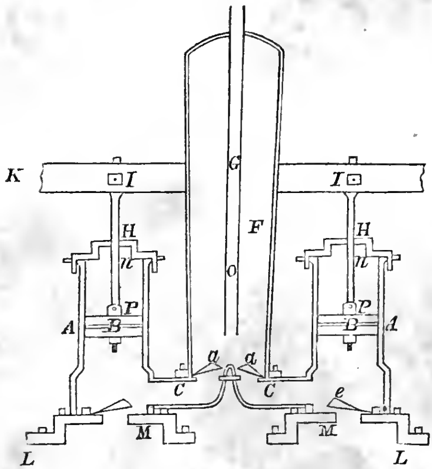
Benjamin Henry La Trobe was the second son of the late Rev. Benjamin La Trobe, a descendant of a noble Protestant family from Languedoc, and Superintendent of all the establishments in England belonging to the church, known by the name of *Unitas Fratum.* He was born in 1762, and educated at Fulnee, near Leeds, and at fifteen years of age commenced his college studies, at Nisky, in Saxony, where he distinguished himself as a scholar of much genius, having every facility for the attainment of all kinds of useful knowledge, besides the learned languages, mathematics, and philosophy. Here he manifested a great delight for drawing, and particularly for Architecture.

Returning to England in 1785, he obtained an appointment in the stamp office, presented to him by the lords Commissioners of the Treasury, in consideration of the great esteem in which his father was held by the existing governments. But the employment not suiting his feelings and active mind, he entered the office of an eminent Architect in the city, and afterwards that of another professional gentleman, with whom however he remained but a short time.

While pursuing his studies at home, he was visited by a friend, Mr. Sperling, who, finding him disengaged, and admiring his growing talents, commissioned him to design and build for him a mansion near Grinstead, to be called Hammerwood Lodge. It is now in the possession of Dorrian Magens, Esq.

This building obtained for him the further patronage of Mr. Trayton Fuller, for whom he designed a house at Ashdown Park; and being further established in his profession, he about this time married the daughter of the late Rev. Mr. Lellon, rector of St. James Clerkenwell, with whom he lived in the enjoyment of true domestic felicity. She brought him a son and daughter; but the birth of a third child proved fatal to the mother, and this sudden bereavement threw Mr. La Trobe into a nervous disorder that led to much derangement of his affairs, which, having reinstated, he formed the resolution of quiting England for America, with the intention of visiting his uncle and establishing himself in that country.

[We are indebted to a friend for the preceding article, copied from Ackerman's Repository for January 1, 1831.]




## FIRE ENGINES.

Messrs. Editors—In a former number of your Magazine, is an interesting article on Fire Engines, at the head of which, is a perspective view of one on Newsham's principle, and no doubt was recognized as one of the favorites of this city. The writer of this article very justly observes, that although there are many different forms and arrangements of the working parts, yet they all act on the same general principles—the compression of air, to produce a continued stream. It is well known, that many important improvements have been made in the form and structure of this most useful machine, and that the grand desideratum to be gained, is, the forcing the largest quantity of water to the greatest distance, with the least exertion. To accomplish this, Mr. Newsham placed his pumps parallel to the ends, while others arranged them parallel to the sides. The drawing above is intended to represent a section of one of this kind, and will be understood by the following description and letters of reference in the cut.

'A A are the chambers or pumps, which are made of brass. The part in which the piston works is bored and polished ; they are bolted down upon the seats M, which are in like manner secured to the bottom of the engine by bolts through the feet L. The pistons B B are two metal disks, each enclosed in leather, pressed into the form of a cup ; the bottom of these cups come in contact with each other, and the disks, and leathers, are firmly connected by the piston rods *n n*. The centre of the levers being permanent, these rods are made to work on a moveable pin P, and passing through the guide H, are alternately raised and depressed by the

motion of the lever K, (a portion of which is represented,) moving upon its centre G. When the piston is raised the chamber fills with water, which is forced into it by the pressure of the atmosphere on the surface, through the opening in the seat M. It is then depressed, the valve *e* closes, and the water passes up through the waterway *c* into the air-vessel F, and is there retained by the closing of the valve, or until by the frequent and alternate operation of the pistons, the air in the air vessel is so far condensed, that by its reaction it forces the water through the pipe O, on any object towards which it may be directed.'

This engine is of the form preferred and adopted by most of the firemen of Philadelphia, and one of which, No. 18, belongs to our present fire department, so that any who are skeptical in regard to the merits of the Philadelphian, can easily satisfy their doubts at the next fire. The chambers, air vessel, &c., are the same as Newsham's, and the only difference is, that the situation of the chambers is such, that the piston rods are attached direct to the levers, or breaks, and prevents the necessity of using chains, and sectors; and if it operates as well, it must be decidedly superior—for simplicity is the soul of improvement. J. M. W.

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### MINIATURE STEAMER.

A Miniature Steamer owned by Messrs. E. and G. L. Hanks,—the engine of which was constructed by the last named gentleman—has excited the attention of many of our citizens. She is only about eighteen feet in length, 'from stem to stern,' and has but five feet beam. She is a most beautiful model—perfect as to exact keeping and proportion--and when 'the fit is on her,' she moves about the noble Connecticut, with three or four passengers, with all the grace of Steamers large enough to receive her into their boilers. She has voyaged as far as Wethersfield—and after having gone to Springfield, 'the proprietors and owners' intend to visit New York in her—taking care to 'hug the shore.' Mr. G. L. Hanks, is the young gentleman, whose 'miniature engine'—now in Washington College—we noticed favorably, many months since.—*Connecticut Mirror.*

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## ANSWER.

Messrs. Editors—A correspondent in the fourth number of the Young Mechanic inquires why the atmosphere is never dark on a windy night. The following ideas upon the subject I, will offer, as they may assist him in solving the mystery. It is well known that clouds are formed of water, which rises from the earth in the form of vapor, or steam; this, at a certain degree of heat, is more opaque, or cloudy, than at any other. This can be proved by the steam issuing from the spout of a tea-kettle when boiling. By examination, it will be found that near the hole from which it issues, the steam is quite transparent, and likewise

at about a foot distant, while in the space between it is very opaque, and objects can scarcely be distinguished through it. From this, I would infer a reason for the atmosphere being brighter on a windy night;—for with an increase of wind, there is a change in the temperature of the air, which, if colder, condenses the vapor, and the particles occupying less space, the light is not so much obstructed, and it follows of course that the atmosphere will be brighter. It may also be assisted considerably by the velocity of the winds, separating the particles still farther from each other, than by being simply condensed. In regard to the condensation of the vapor by the wind, my ideas were strengthened by observing, that on the increase of wind on a cloudy night, small quantities of rain fell during the evening, which I supposed might be attributed to the vapor being rapidly condensed by the change in the air, and uniting in drops, fell in the form of rain.

I have thus given a few ideas upon this phenomenon, and I hope some of your correspondents will give it some attention. It is, in fact, a subject upon which much might be said, and good arguments be used, although it is apparently extremely 'light and airy.' J. M. W.

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## QUESTIONS.

To find that number, which being doubled, and 16 substracted from the product, the remainder shall as much exceed 100 as the required number itself is less than 100.

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Messrs. Editors.—It will oblige me, if some of your correspondents will answer the following question.

How much *horse power* is a steam engine of the following dimensions equal to?

Pressure of steam to the square inch, 75 lbs.
Area of piston 28 square inches.
Length of stroke 22 inches.
Double strokes per minute, 75.

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Messrs. Editors—Will you oblige a correspondent, by inquiring through your Magazine the cause of the following accident? A decanter was placed on the shelf of a bar room in this vicinity, when suddenly the glass stopple broke into a number of pieces without injuring the decanter or the witnesses being able to account for it. J.

THE

# YOUNG MECHANIC.

Vol. I. AUGUST, 1832. No. VIII.

## OBSERVATIONS ON DRAWING INSTRUMENTS.

[Continued from p. 99.]

### THE TRIANGULAR COMPASSES.

*The Triangular Compasses* are a very useful instrument for determining the distance of any one point from two others, given in position. They simply consist of a common pair of compasses to whose head a joint and socket is fitted for the reception of a third leg. The third leg being connected to the others by a universal joint, as it were, can be moved in any direction, either from or towards the draftsman, or to the right or left.

*The wholes and halves* will sometimes be found convenient for dividing lines into two equal parts, deriving their name from this property. To use them, open the longer legs so as to take in the required line, then invert the compasses and the shorter legs will contain just half of it.

*Proportional Compasses* have points at each end; the centre or joint, being moveable, is between them. They are for reducing drawings in any required proportion; thus any distance being measured between the two long points, by inverting the compasses, the short points will give a distance in any required proportion to the former, by altering the position of the centre or joint. The limbs or legs have grooves made in them, the sides of which are cut in a dove-tailed form, and pieces of brass to match, are fitted into them. These two pieces are united together by a steel pin, which passes through them, having a head on one side and a milled nut on the other, for clamping them together and fixing them fast in every part of the grooves where they may be set. When this nut is loose and the shanks are closed, by applying the finger and thumb to the sliders they may be moved up and down in the grooves, and the centre set in a situation for any required proportion, by means of scales on each side of the grooves and an index on the slider. The scale on the right hand of the first side is entitled *lines*, numbered from 1 to 10. By this scale a straight

line may be divided into any number of equal parts expressed on it. The compasses will then reduce a drawing in any proportion, by measuring the distances of the original by the large points and transferring them to the copy by the opposite points. The two legs when closed, are prevented from slipping on one another, by a small stud or projection which is formed in one and enters into a notch made in the other. On the opposite edge is a line of divisions entitled *circles*. Being numbered from 1 to 20, the points may be opened in any proportion of the radius of a circle to the side of an inscribed regular polygon from 3 to 20 sides. Two other lines of divisions are placed on the back, one entitled *plans*, and the other *solids*. These lines are for finding the square or cube root of any number. The areas of similar plane figures, being to each other as the squares of their sides, and the solidities of similar solids being as the cubes of their homologous sides, these compasses will be found very useful in ascertaining the proportions of any two similar planes or solids to each other. Thus, set the index to the division 4 on the line of *plans*, and measure the side of any square or right lined figure, and the distance between the short points will indicate the side of a figure the area of which is one fourth of the other.

The line of *solids* may be used in the same manner for determining the proportions between cubes or spheres. Set the centre on division 3, and then measure the diameter of a sphere or side of a cube in the long points, and the distance in the short points will denote the diameter or side of a similar solid of $\frac{1}{3}$ the cubic contents of the former.

The best kinds of proportional compasses are provided with an adjusting screw and clamp, precisely similar to that before described as sometimes attached to the dividing or measuring compasses.

*The Pocket Compasses* are a very valuable little instrument, being as it were, a complete set of drawing instruments united in one. The shanks meet in a joint at the top and are hollow for the reception of the legs, which are each formed into two distinct instruments having a joint in the middle. One leg is composed of a plain point at one end and a pencil at the opposite; the other consists of a plain point as before, and a pen at the other end. The joints are formed above and below, like the joint to the shifting leg of the drawing compasses, and fits into the sockets in the end of the shanks. This admits of either point being brought into use, for either end of the leg may be introduced into the hollow of the shank, and then the opposite end will be in use.

This instrument is very convenient on account of its portability; for the points or legs being put into the sheaths which are provided for them, may be turned inside of the shanks, and the instrument carried about in the pocket without any case. The shanks may be formed like the tubes of a telescope, so as to be drawn out to describe circles of large radii.

An instrument of this kind was invented by M. J. Brund, an

English civil engineer, the legs of which, instead of fitting into the shanks, turn in the centre on screws, in the end of the shanks. In this way, the points may be changed very readily, simply by inversion. This is a much better contrivance than the former, as by its construction all shake or looseness is avoided. When the tubes of which the shanks are composed, are drawn out, the compasses will describe a circle of twenty inches radius, although they are when closed, only four inches in length.

*The beam compasses* are used for measuring long distances and describing circles of very large radii. They consist of a long beam of brass or wood, and two brass sliders fitted upon it. One of these which contains the pen or pencil point is fixed upon the end of the beam, and sometimes has a micrometer screw for accurate adjustment, the other, being moveable along the beam, may be confined at any spot by a clamping screw in the top.

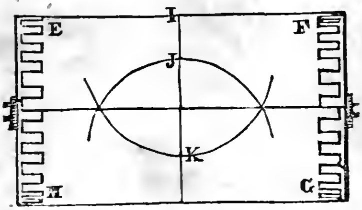
In the best instruments the hand of the micrometer screw has divisions cut on it, by which the quantity the point is moved, may be ascertained with great precision. The compasses are often provided with duplicate plain beams, which may be attached to the first by a slider with two screws. When arcs of circles of very large radii are to be drawn, the beams are very liable to bind by their own weight; and this, throwing the points from each other, destroys all accuracy. This may be remedied by having sliders, with small wheels attached to them, to roll upon the paper, which may be confined in the centre or any part of the instrument.

We have now described all the compasses which are worthy of notice; for though there are various other kinds in use among artists, yet none are so perfect as the above . We shall conclude by giving a few remarks on sharpening the compasses. When the points by gradual wear, become dull or blunted, they are to be repaired on an oil stone or hone. The insides of the points should at first be laid very flat on it, and rubbed steadily along the surface, till on shutting them together, the two points meet as one. They are then to be closed fast, by winding a string round them or in any other convenient way, and both points to be rubbed at once and sharpened as if they were but one point. After this is done they should be opened and the ends of the points polished, to preserve them from oxidating.

No accurate measure can be taken in compasses, the joints of which are tight, so as to cause the legs in opening or closing, to spring, because when the points are brought to the required distance by the fingers, they alter the instant the pressure is removed; which variation in some compasses amounts to a very considerable quantity.

## MECHANICAL GEOMETRY.

Under this head we intend to give examples, showing the application of geometry to mechanical purposes. The following is from the London Mechanic's Magazine.—Eds.




Proposition.—To draw a line upon the surface of a cylinder, which shall be exactly parallel to the axis. Suppose E F G H to be the contour of a cylinder; apply any point while revolving at or near the middle, so as to describe a ring upon the surface, as at I; then set your compasses at any convenient distance, say at K, and make the arc J; then set the point at J, and make the arc K; a line drawn through the intersection will be parallel to the axis.

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## MEMOIR OF A MECHANIC.

Messrs. Editors,—Your politeness in publishing several articles of mine, has induced me to send the following sketch for your disposal. Philo.

I was born in England, on the 22d of August, 1790, about 100 miles from the metropolis, and one mile from a market town, in the north-eastern part of the country. My parents, though poor, were honest and industrious. Neither of them could read or write; and feeling this deficiency, they were determined to do what they could for their children, (five in number, two older and two younger than myself.) They put me, at the age of five or six years, to a school kept by a woman; and, at seven years old, I was sent to a school-master in the adjacent market town, for two years, except during harvest time, when I was taken away to assist my mother in gleaning; which is a great help to the poor in that part of the country.

My schooling was paid for by a benevolent lady, who, while she lived, kept six boys and six girls at school for two years each; one half of whom left school every year, to give place to new ones.

Sometimes it was difficult to find suitable children to send. In my own case, I was sent a year earlier than was usual, and that to fill a vacancy occasioned by a boy being taken from school, after three months' trial. He was a dunce, and in the habit of playing truant. This the master could not allow; as his credit was at stake,—for this lady obliged him, with his twelve scholars, to attend at her mansion every year, where each used to read and answer questions. She would enquire of those about to leave school

what books they had; and order the master to furnish such as she thought they needed most. After this ceremony was over, she gave each of us a shilling, and told us to proceed to a room, where we sat down to a sumptuous dinner, and were attended by the servants.

I feel it my duty to record the goodness of this amiable woman. She not only instructed the ignorant, but fed, warmed and clothed those who stood in need of it. I made the best of this opportunity, to get a little learning, which was confined to reading, writing and arithmetic; and was tolerably quick at the latter. When I left school, I had reached the Rule of Three, and was about nine years old. My father, being a day-laborer, had no particular employment for me; so, to keep me from mischief, I was set to spinning wool by hand, for a year or more; when I was released to take care of a flock of sheep, feeding by the road-side in the day-time, and turned into a field at night. I disliked this employment very much, through fear of losing any of them; and I often counted them many times a day. They often broke into other persons' enclosures. At such times, they were very noisy; the old ones would call their young towards them whenever they were about leaping a fence. In fact, I became so tired of their noise, that the bleating of sheep gave me pain for years afterwards.

I was next engaged to work in a garden for supplying the market, until I was between twelve and thirteen years of age, when I was apprenticed to a trade. My father had some notion of putting me to the trade of a painter and glazier; but I did not like the idea of working so much on ladders and temporary stages, suspended in front of lofty buildings. I had, finally, to decide between the trades of a carpenter and a whitesmith. I made choice of the latter; and do not recollect that I have regretted it, although I have practised that and similar branches for about thirty years, commencing April 6th, 1803.

My agreement was to serve seven years, and receive a certain sum of money weekly as wages; and if I served my time out duly and truly, my master promised to give me ten pounds. My father was to find me in board, lodging and clothing; and as he lived about a mile from my master's shop, I had that distance to walk every morning and evening. We worked from six in the morning until seven in the evening, taking out an hour and a half for meal times. On Saturday night we left work at six o'clock.

I had not been long at my trade, before I found the benefit of my schooling. There were two other apprentices, much older than myself, neither of whom could take an account of the work as it was delivered from the shop. The foreman was very glad to put this task upon me; and I was as willing to do it. The master was engaged in his sale-shop (hard-ware store), and the apprentices were occasionally called upon to assist when he was absent, or on a market day. This, together with the great variety of work done in our shop, afforded considerable scope for the abilities of any young man. We either made or repaired almost every article made of metal, used about a house, whether in its structure, or in

the domestic department, together with tools used by mechanics, and some work for mills.

The first money I received was at Christmas time, when the apprentices have the privilege to call on their masters' customers for a Christmas box. My share was about half a guinea, with which I bought a Bible containing the Apocrypha, as I wished to have it complete, and a thick ciphering-book. At the beginning of the year 1804, I began arithmetic anew, going through more thoroughly than I had done at school; writing in every rule and case, and using a greater variety of examples. I sought advice and assistance from anybody and everybody that came in my way. One of the most efficient of my advisers, was a journeyman carpenter. He had several books full of examples in mensuration of superfices and solids, embracing the methods of measuring various kinds of artificer's work. The figures or diagrams were very neatly drawn. I had several lessons of an evening from this man, but he was soon taken away, having to undergo a surgical operation for a complaint. He died a few days afterwards. His books were purchased of the widow by his employer, a numskull at writing, whose accounts were kept by his wife.

This employer used to delight in teasing his journeyman about his knowledge. 'Tom,' says he, sitting one day at a tavern, 'there is a coach going by; tell me how many times the hind-wheel will turn round in going to London.' 'Give me the size of it,' was the reply. 'O, any fool can do it so; you ought to tell without that.' He was often treated so in company, by way of derision. Thus, people undervalue what they cannot reach. 'Ah!' says the fox, looking up at the grapes, 'they are sour things!'

Sometimes, however, poor Tom had the advantage over his employer. The lady I have spoken of, wrote to the carpenter, requesting him to build a pheasant house, to be placed in a shrubbery near the mansion. The form was to be a hexagon, if the thatcher could thatch it of that shape. He soon began to coax Tom, to get him into a good humor; for he verily believed him to be the only man from whom he could learn the number of sides in a hexagon. Tom referred him to his brother John and others, but to no purpose. At last he told this very cunning man the number of sides it contained. By purchasing Tom's books, he expected to be able to beat everybody in the neighborhood. I wished to obtain them, but that was impossible.

I was never more sorry at the loss of a relation, than I was at losing this man, as I had made up my mind to study as much as I could with him.

My leisure time was now devoted partly to study, and partly to mechanical pursuits. I made several curious articles during my apprenticeship; the one of most consequence was a clock. The death of my friend gave me an opportunity to purchase a small bench-vice, and some other tools of his widow. I made myself a small lathe, chiefly of wood, and several other tools, before I commenced on my clock. It was in the examination of a large church

clock, that my attention was first drawn to this subject; the wheels being large, it looked much more simple than a common clock. The principal difficulty I apprehended, was in the motions necessary for the hands; where some of the axes passes through the others. The materials to which I had access, were not very suitable for the work; however, I commenced operations. It will be understood, that, as I lived so far off, my meals were taken in the shop, my mother putting what was necessary for me to take every morning, into a small basket. This plan gave me considerable time to prepare those parts at the shop, that I could not do so well at home. (My master never expressed any objection to my amusing myself in this way: in fact he did not trouble himself about it.) I prepared two plates of sheet-iron for the frame: these were kept at a suitable distance apart by four pieces of iron wire, which were rivetted into the back plate—the front plate was moveable. These plates were bushed with brass wherever it was necessary for the pivots of the several axes to pass through them. This, in point of utility, was as well as though the plates had been made wholly of brass. The wheels were of sheet brass, cut from the bottoms of old brass kettles. It was too thin, but was the best I could get. Having prepared my wheels, and fastened them on pieces of wire, the turning, dividing and cutting the teeth were performed at home.

I often smile, when I think of the scene presented when I first began. It was winter time; my mother was sitting on one side of the fire, and the other was occupied by some members of the family. Being very cold, that side of the table farthest from the fire was vacant. I screwed my vice on this side, and pinched my lathe in the vice, putting my axle, with the wheel on it, between the dead centres of the lathe. The motion was given by a drill-bow, the string of which passed round a whirl, placed temporarily on the axis. This bow is moved by the left hand, while the tool is held firmly in the right. In this manner the wheels, pinions and pivots were all turned; the dividing was done by a pair of small spring dividers, and the teeth were formed with a file. Parts of the work required hammering. This was more than some of the family could endure; and it induced them to furnish me with a separate light, and I had to decamp. I found a place up stairs, screwed my vice to the bannister rail, and, with a piece or two of board, I formed a bench, and was now fixed for the winter. In the following summer I made a much better establishment in a shed in the yard, where I completed my task, to the wonderment of all the old women in the neighborhood, but not exactly to my own satisfaction; although I thought it was as well as could be expected, taking all the circumstances into view. It kept time tolerably well, and would show the hour and minute on the front dial. It had an hour hand on each side; I had never seen this before, although I had heard of it. The weight moved only thirteen inches; and required winding up once in about four and a half days.

It is impossible for any one who has never tried it, to conceive

what pleasure there is in attempts of this kind; especially when the mind marks out tracks that have never been trodden before. Sometimes months, and even years must elapse, before the object of our pursuit can be brought to an issue; during which time there is a strong belief that the thing can be accomplished; although many unforeseen difficulties occur, which set us to thinking. Here is something to study about. Now and then, a faint ray of light seems to point out the course we ought to pursue: by and by a blaze bursts as it were upon us, and the object can now be accomplished with ease. This brings pleasure somewhat in proportion to the labor spent in searching for it; or according to the benefit likely to arise to mankind, or to the individual making the discovery, modified, of course, by the disposition of the person engaged in the operation. Many times I have been bent upon the accomplishment of some object that required great attention: which I found was more easily done in the night, when the family had retired to rest, and all around was still. At such times, sleep would be banished from my eyes, there being something so fascinating in it, that the time flew unconsciously by; and I retired to bed, rather for a screen to prevent the interference of others, than for the sake of rest.

[To be continued.]

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From the Franklin Journal.

## ON SOFTENING CAST IRON.

THE subjoined extract from the reports of Mr. Strickland (just published) will probably bring to mind some statements made in our first number, on the subject of the art of rendering cast-iron malleable, as practised in England. The *Cumberland red ore* is, it appears, found in various parts of the Island of Great Britain, and there are, undoubtedly, several varieties of iron ore in the United States, which will answer the same purpose. The Cumberland ore is probably an *argillaceous oxide of iron.* The *Hematetic Iron ore*, which consists of oxide of iron, silex and alumine, has been successfully used in England, but as it is a very hard substance, the difficulty of reducing it to powder in sufficient quantities, is a bar to its employment in the large way.

The *Ochery red oxide of iron* (red-ochre) is known to abound in many of the States, and is, probably, similar to that of Cumberland. The *Bog-ore*, so abundant in New Jersey, and in many other places, would be likely to answer the purpose, when not contaminated by phosphate of iron. Those who are interested in experimenting upon the subject, would do well to make the essay with the several varieties of ore which they can obtain, as the comparative goodness of each might then be ascertained, in a single operation.

'There has been a method lately discovered, to make cast metal soft and malleable; and there are already many large manufactories put up, for this very important process. I have visited one of them in London, and witnessed the operation. The method consists, in placing the cast metal in a case or pot, along with, and surrounded by, a soft, red ore, found in Cumberland, and other parts of England. The cases are then put into a common oven, built with fire-bricks, and without a chimney, where they are heated with coal or coke, placed upon a fire-grate. The doors of the oven are closed, and but a slight draft of air permitted under the grate; and thus a regular heat is kept up, for seven days, or two weeks, depending on the thickness and weight of the castings. The cases are then taken out, and suffered to cool, and the hardest cast metal is, by the operation, rendered so soft and malleable, that it may be welded together, or when in a cold state, bent into almost any shape, by a hammer or vice. In this manner are all articles, such as harness buckles, bridle bits, horse shoes, and even nails, made tough and malleable. Cast horse shoes, submitted to this process, have, after being worn out by the action of the horses' feet, been converted into penknives, and other articles of cutlery, of superior quality. I have procured a specimen of the red ore used in this valuable process, together with a few articles of the hardest cast iron, which have been softened, and rendered perfectly malleable. Those castings, however, which are made from pig iron containing the smallest portion of carbon, are the best adapted for conversion into malleable iron: the only effect produced by the introduction of the red ore, along with the metal, is to deprive it of its carbon.'

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## BLUE COLOR OF STEEL.

Messrs. Editors,—Your correspondent, Gulielmus, having propounded several questions, relating to the process of blueing steel, I will attempt to give a few ideas upon the subject; by the aid of which, and a little experience, he may possibly succeed to his satisfaction. His inquiries are, first, the best method of producing the blue color upon iron or steel. Secondly, the cause of the color being so easily rubbed off from the piece which he tried; and thirdly, the nature of the color. To answer these inquiries, it will be necessary to reverse the order in which the questions are asked; and first, consider the nature and the materials of which the blue is composed.

All metals more or less oxydize upon exposure to the atmosphere, being partly composed of oxygen gas. An oxide of a metal is formed by the union of oxygen gas with the metal, and is, when not produced by heat, known by the common name, rust. Thus iron rust is the yellow oxide of iron. All changes which take place upon the surface of this metal, either from exposure to air, water,

or heat, is an oxide. And if, after polishing the steel or iron, it is subjected to different degrees of heat, the surface will be more easily acted upon by the oxygen of the atmosphere; and will first assume a yellowish tinge, and gradually deepen (with an increase of heat) to orange, red, blue and black, which is the last oxide formed by heat. By this it will be seen, that the blue color is the blue oxide of iron, and is composed of oxygen gas and iron.

The next question is the best method of producing the blue oxide. As Gulielmus does not inform us of the method which he adopted, in performing his experiments, I am not sure but that I shall mention one inferior to his own. It must be evident, that to produce an *equal color*, an *equal heat* must be applied. This is done by immersing the steel in melted lead or tin; or by putting it in a vessel surrounded with charcoal dust, and subjecting it, in this state, to the necessary heat. But for small articles, covering them with common house sand, instead of charcoal dust, or, if the pieces are flat, lay them on sand spread upon a plate of iron, and placed upon the fire, so that the heat must pass through the sand; which will make a good tempering bed, and produce an equal color upon the work.

It now remains for us to answer the third and last question, why was the color so easily rubbed off? This question I find some difficulty in answering; as there are several causes which would produce such an effect: but the following opinion I will submit, as the probable cause. In his communication, Gulielmus observes, that the pieces used, were of sheet iron made smooth, and burnished before blueing. I would observe here, that iron will not produce as bright a blue as steel; and the harder the steel, the more brilliant the blue, and perhaps the more permanent. The reason of the color being so easily removed, I conceive to be this; in burnishing, oil is generally used, to keep the tool from scratching, and although the work may afterwards be wiped, yet some will remain in the pores of the metal, until the heat is applied; when it will be thrown out upon the surface. This will not prevent the oxide from forming, but it will prevent it from adhering; for, as fast as the oxide is formed, it would be separated from the iron by the oil, and could be brushed off, in the manner described by Gulielmus.

J. M. W.

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## BOSTON MECHANICS' LYCEUM.

### ORIGIN.

As this institution, owing to its somewhat peculiar character, is but partially known among the mechanics of our city, I have thought proper to prepare an account of its origin, and progress to the present time, for the Young Mechanic.

The first meeting in favor of forming a Mechanics' Lyceum in this city, was called by Mr. Josiah Holbrook, Feb. 5th, 1831. Mr.

Timothy Claxton presided, and Mr. W. S. Baxter acted as Secretary. The evening was occupied by the discussion of the question, 'Has any class of the community stronger inducement or better opportunities for mental improvement than practical mechanics ?' which was decided in the negative. The meeting adjourned to Feb. 12th, for the discussion of another question, and to take into further consideration the subject of forming a Lyceum. At this meeting a proposition was made to form an association to be called the 'Union Lyceum,' and another, to form one, to be called the 'Mechanics' Lyceum,' both of which were referred to the next meeting, which was voted to be held Feb. 19th. The latter proposition prevailed at this meeting ; and a committee was appointed to draft a Constitution, to be reported at an adjourned meeting, Feb. 25th. The Constitution reported by the committee at the meeting of this date, was adopted, with a few amendments. The following is a copy, with the exception of two or three amendments which have since been made—the only one of which of any importance, is the alteration of the annual assessment from $2 to $1.

CONSTITUTION.

ART. 1. The Society shall be known by the name of the Mechanics' Lyceum. Its object shall be, mutual improvement in useful knowledge.

ART. 2. Any person, having been proposed at a meeting of the Society, and elected by a vote of two thirds of the members present at a future meeting, by signing this constitution, and paying one dollar, shall be entitled to all the privileges of membership.

ART. 3. There shall be an annual assessment of one dollar on each member, payable on the first of September. No member will be allowed to attend the exercises of the Lyceum, until he has received his season Ticket; and any person neglecting to procure a ticket for one year, shall forfeit his membership.

ART. 4. The meetings of the Society shall be held once a week for discussions, lectures, or such other exercises as may be thought best to accomplish the object of its members. The last meeting in each season shall be the annual meeting, when the committee shall make a report of the doings of the past year, after which a new committee shall be chosen.

ART. 5. The business of the Society shall be transacted by a committee of five ; viz. a President, Secretary, Treasurer, and two Curators, who, together, shall constitute a Board, to take charge of the affairs of the Society, and to devise and recommend such measures, as in their judgment they shall deem expedient.

ART. 6. Each member shall have the privilege of introducing ladies to witness the exercises ; who may hand in compositions on the subjects under consideration, or on such others as they may choose.

ART. 7. This constitution may be altered or amended by vote of two thirds present at any regular meeting, the same having been proposed in writing, at a previous meeting.

After the adoption of the Constitution, the following persons were elected officers for the first season:—TIMOTHY CLAXTON, President; GEORGE W. LIGHT, Secretary; JAMES COOPER, Treasurer; WILLIAM S. DAMRELL and JOSEPH WIGHTMAN, Curators.

FIRST TERM.

At the first regular meeting of the Lyceum, the following list of exercises was proposed and adopted:

MARCH 5.—1. Matter and its properties. 2. Attraction. 3. Repulsion. 4. Motion from forces in the same direction. 5. Motion from forces acting in various directions. 6. Centre of gravity. 7. Essay addressed to Mechanics.

MARCH 12.—*Question.*—'Which has been the greatest benefit to Mankind, the discovery of the Magnetic Needle or the invention of the art of Printing?'

MARCH 19.—1. Lever and Balance. 2. Wheel and Axle. 3. Pulley. 4. Inclined Plane. 5. Wedge. 6. Screw. 7. Essay, Rise and progress of Mechanics' Institutions.

MARCH 26.—*Question.*—'Are Females endowed by nature with intellectual abilities equal to those of the other sex?'

APRIL 2.—1. Air, Atmosphere. 2. Weight of the Atmosphere. 3. Pressure of the Atmosphere, Barometer. 4. Common Pump. 5. Elasticity of Air. 6. Fire Engine. 7. Essay, Economy of Fuel and construction of Chimneys.

APRIL 9.—*Question.*—'Which is most conducive to happiness, ignorance or knowledge?'

APRIL 16.—1. Water, Rivers. 2. Springs. 3. Pressure of water. 4. Water Wheels. 5. Water Pumps. 6. Water Syphon. 7. Essay on the Ocean.

APRIL 23.—*Question.*—'Are the modern improvements in labor-saving machines, beneficial to the community.'

APRIL 30.—1. Printing Press. 2. Screw Standing Press. 3. Hydrostatic Standing Press. 4. Steam Engine. 5. Steam Boat. 6. Steam Carriage. 7. Essay on the Mechanic Arts.

MAY 7.—*Question.*—'Are early marriages generally advisable?'

MAY 14.—1. Definitions of geometrical figures. 2. Definitions of geometrical solids. 3. Mensuration of right lined figures. 4. Mensuration of curved lined figures. 5. Mensuration of solids with plane faces. 6. Mensuration of solids with curved surfaces. 7. Essay, History of Geometry.

MAY 21.—*Question.*—'Which has the greatest influence in forming the character of the child—the father or mother?'

The subjects of the Lectures here enumerated, together with those of the Essays, were treated upon by the members of the Lyceum—seven of them taking parts on the evenings of the Lectures, and each one occupying about a quarter of an hour. Essays on the subjects for debate, were written by females introduced by members of the Lyceum, which gave an increased interest to the discussions and exhibited a laudable talent for composition which the females of our community, especially the wives and daughters of mechanics, are seldom acknowledged to possess.

At the last meeting of the season, May 5th, the same officers were chosen for the second term, except that Mr. William S. Baxter was elected a Curator in the place of Mr. William S. Damrell.

### SECOND TERM.

At the first meeting, June 7th, the following subjects for Lectures were adopted:—Architecture; Political Economy; Botany; Geology; Natural History; Astronomy; Biography of Practical Men. The members were left to choose their own subjects for Essays. At the next meeting, Sept. 27th, it was voted that Declamation should be added to the regular exercises of the Lyceum, which was afterwards found to increase the interest of the society, as well as to elicit a species of talent, and effect an improvement which has been too long and too much neglected. It also had the tendency to increase the confidence of speakers in debate.

At the last meeting, the following persons were elected officers for the third term:—TIMOTHY CLAXTON, President; JOSEPH WIGHT-

MAN, Secretary; ELISHA TOWER, Treasurer; WILLIAM S. BAXTER, and DUNBAR B. HARRIS, Curators.

As to the success of the Lyceum, thus far, notwithstanding its number of members has been small, the improvement of those who have devoted their attention to it, has exceeded the anticipation of the projectors. They now feel confident, that the plan of having the exercises conducted by the members alone, is not only in accordance with the true Lyceum system, but far more productive of solid improvement, than the mere attendance upon popular lectures. In the one case, the members acquire a habit of doing their own studying and speaking, and consequently of calling into exercise the faculties of their own minds, and using the means for improving their own manner of delivery; while in the other, most of the hearers of popular lectures retain little of the instruction they receive, and are too apt to go away with the impression, that because the lecturer's duty is performed, their own task is as certainly completed. If the former obtain only a *smattering* knowledge of science—which we maintain is not the case—the latter do not acquire even *that*. It is not my design to derogate in the least from the real merits of the popular system of conducting Lyceums. While kept within its proper sphere, it may be of extensive benefit, but I do maintain, that popular lecturing ought not to be the *regular* exercise of any institution, the professed object of which is *mutual* improvement. I am aware of the difficulty of giving very great popularity to an Association which depends wholly upon its own resources for advancement in knowledge; but still I am of opinion, that the improvement of a Lyceum depends as much upon the faithful exercise of its own powers, as that of an individual does upon his own efforts.

Among the results of the institution, I may mention the existence of this Magazine. The subject was first agitated by a number of the members, who afterwards executed all the necessary measures for its establishment.

GEORGE W. LIGHT.

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## AMERICAN PATENTS.

We have extracted from the Journal of the Franklin Institute, a part of the list of American Patents, which issued in January, 1832, with remarks and exemplifications, by the Editor.

For a Cement for Wood, Brick, Stone, and Iron Work: Richard Walsh, Boston, Mass. January 5.—This cement is to be made by mixing together one quart of ground lime, two of calcined plaster, and three of Roman cement. To these are to be added two pounds of black lead, one quarter of a pound of red lead, and the same quantities of copperas and of litharge.

These ingredients are to be incorporated in boiling linseed oil and spirits of turpentine, in the proportions of one part of the former to two of the latter; and it is said that when brought to a pro-

per consistence for spreading, this preparation will afford a slate colored cement, calculated to defend the material upon which it is laid from the action of the weather. The color may be varied, by mixing with the other materials any suitable coloring ingredient.

When we read the title of this patent, we expected to meet with a cement for uniting substances together, and not with a mere paint for spreading over surfaces in the ordinary way. As a paint, the composition is rather heterogeneous; some of the substances named may be left out without any disadvantage, or others may be added without abstracting from the good qualities of the mixture. The patent, however, is taken for the precise compound, and such as it is, those who use it, must purchase a right, or invade the claims of the patentee.

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For a composition of matter to be used in the Manufacture of Spruce Beer: George Jones, Boston, Mass. January 27.—From the twigs, boughs, and leaves of the double white spruce, a material is to be extracted, without boiling or distillation, which the patentee calls 'the superior improved oil of spruce, for the making of spruce beer.' To form it, two pounds of the leaves, &c. are to be bruised, and soaked for three or four days in alcohol, *of a very high proof.* To every gallon of this, when filtered, three pounds of the essential oil of spruce are to be added: this is the composition for which the patent is taken.

The superiority of this composition over all others, its various uses and great virtues, are enumerated and insisted upon with considerable amplification. To make beer, one ounce of the composition and one gallon of molasses are to be well mixed together, and two gallons of boiling water are then added; a half barrel is to be used to contain the mixture, and is to be filled up with cold water, when its contents are allowed to ferment.

The process of soaking the boughs, twigs and leaves in alcohol, and then making the infusion with oil of spruce, are the things claimed.

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For an improved machine for Breaking and Dressing Hemp and Flax: Ebenezer C. Chase, Jay, Oxford County, Maine, January 6.

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*Specification of a patent for a Wing Gudgeon Valve for Steam Engines. Granted to* Thomas Halloway, *Northern Liberties, Philadelphia County, Pennsylvania, January* 18, 1832.

To all whom it may concern: Be it known that I, Thomas Halloway have invented an improvement in the valves of steam engines, which I intend to apply to locomotive operation only, and which is called the 'Wing Gudgeon Valve,' and that the following is a full and exact description thereof. I intend that the cylinder or cylinders to which my valves are applied, shall vibrate, in general, vertically; but this is not a point of importance, its position being governed by circumstances.

The cylinder is to have one large gudgeon, close to which, above and below, is a face plate, or wing, with an opening leading to each end of the cylinder, longitudinally; which face is exactly in the shape of the segment of a circle, as is shown by a model and drawings, deposited in the patent office.

The piece constituting the valve seats is cast about the width of the boiler, with a plate on each side corresponding with the face on the cylinder, and may be circular, or straight, according to the form of the top of the boiler. This valve seat has two distinct openings leading from a double division cock in the centre to the valve seats which the cylinder vibrates against, and passes out in two openings on each side, corresponding to the openings on the plate of the cylinder; and with the vibration of the cylinder it alternately receives and discharges steam.

It will be understood by every competent engineer that both the face of the plate valve seat, and that of the plate on the cylinder are to be turned perfectly true, and made steam tight, and will be kept up by a spring, friction roller or weight.

The cock, which has been mentioned, in the centre of this valve seat, and on the centre of the boilers, is to be so constructed that by turning half round, it reverses the power of the engine; that is, it makes the steam side the exhaust side, and vice versa; and it also answers to shut the steam from both engines: [qu. ends.]

What I claim as my invention, is the arrangement of the cylinders and valves to a locomotive engine; the mode of fitting the valves; the construction of the cock in the centre to determine the direction of the engine forward or backward; and the simplicity of the whole, not having half the number of pieces when completed, that the generality of English engines have.

THOMAS HALLOWAY.

Fig 1, is the face of that half of the valve which is cast on the cylinder, with openings leading through the steam ways to the two ends of the cylinder.

Fig. 2. A circular plate forming the other half of the valve, faced to fit steam tight on fig. 1. A, is an opening in it, to receive the trunnion or gudgeon B, fig. 1.

Fig. 3. A side view of fig. 2. C, the edge of the plate. D, a double tube connected with the boiler; the cock E changing either of the tubes into a supply or discharge tube.

Fig. 1.

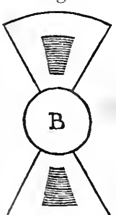



Fig. 2.

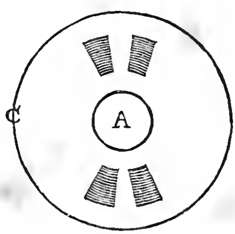
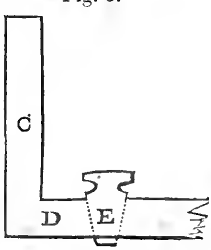



Fig. 3.



## NEW STEAM CARRIAGE.

A new and very powerful locomotive steam carriage has lately been started, and is now plying upon the Glasgow and Garnkirk railway, made by Messrs. Johnson and Macnab, engineers, Port Dundasroad, Glasgow. This is the first steam carriage of the improved construction ever made in Scotland—the St. Rollox and George Stephenson, the only carriages hitherto used, having been made in Newcastle. The Glasgow, alluded to above, is propelled by two engines of seven horse power each, on which several improvements have been introduced, and, in point of speed, strength, workmanship, and appearance, is allowed by competent judges, to surpass any steam carriage hitherto seen in this country. Her speed has not as yet been fairly put to the test, this railway not being favorable to such trials, but we understand that with all disadvantages it has attained a maximum of speed hitherto unprecedented in the annals of steam conveyance, and scarcely, if at all, surpassed in those of the turf. As an instance of her power we may mention that on Wednesday, the 1st current, she drew along the line, in the ordinary course of trade, thirty-six loaded wagons, and two wagons loaded with passengers, making a gross weight of 155 tons, in the space of one hour and six minutes, including two stoppages, or at the rate of eight miles and a quarter per hour.

*Scotch Paper.*

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## QUESTION.

I should like to inquire if there is any way (in this changeable climate) of putting thin sheet lead on the roofs of buildings so that it will not crack, I think if Plumbers would turn their attention to it, it might be effected, and they would be rewarded with more work, and the public be blessed with tight roofs.

P.

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### *Answer to the first Question in the last number.*

The number sought being denoted by $x$, the double thereof will be represented by $2x$; from which substracting 16, the remainder will be $2x - 16$; and its excess above 100 equal to $2x - 16 - 100$: therefore $2x - 16 - 100 = 100 - x$, *by the question;* whence $3x = 216$; and consequently $x = \frac{216}{3} = 72$.

THE

# YOUNG MECHANIC.

VOL. I. SEPTEMBER, 1832. No. IX.

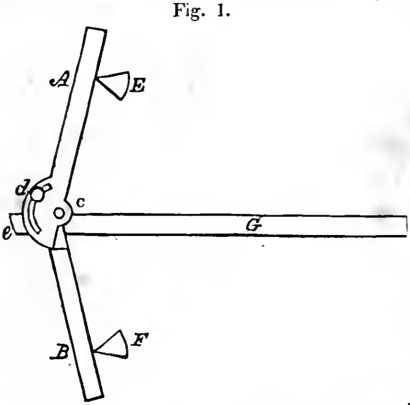
## OBSERVATIONS ON DRAWING INSTRUMENTS.

[Continued from p. 115.]

### OF OTHER INSTRUMENTS FOR DRAWING AND DIVIDING CIRCLES.

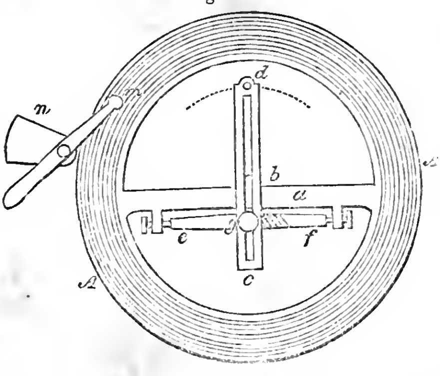
IT frequently occurs that circles are to be drawn the radii of which are so long that they cannot be comprehended in the beam compasses. To accomplish this many instruments have been constructed, of which the following is a description. Fig. 1 is called a *cyclograph* or *curvilinead*, and consists of two rulers A. B. united by a joint at C, by which they may be placed at any given angle with each other. Each at the end has a semi-circular part behind the centre, in the upper of which is a groove for the reception of the screw *d*, which is tapped into the lower one, and by screwing this tight the two may be clamped together so as to be immovable at any angle at which they may be set. The centre pin of the joint C is formed like a tube having a hole perforated through it for the reception of an ink or pencil point, and in such a position that its point is in the intersection of the edges of the two rulers A B. To use the instrument the two weights E F, are laid upon the table, and the angular edges applied against the rulers, as shown in the figure, and it being slid against them, the point in the joint C describes the arc of a circle. Two pins or needles would answer the same purpose as the weights, and are often used instead of them. The weights have each, three very small pins on the underside, which stick into the paper and prevent them from slipping. The instrument will draw an arc of a circle of any

Fig. 1.



required radius by altering the angle of the rulers. The mode of adjusting it is very simple. First, mark on the paper two points which are to be the extremes of the intended arc, then having drawn the chord and its versed sine, we have given three points in the curve. Fix two pins or the weights to the two points, and apply the instrument to them. Open the angle of the rulers till the pen at the vertex coincides with the point c, fasten them by the screw, and by sliding the instrument against the pins, the pen will describe upon the paper the proper curve. Another ruler G is sometimes attached to this instrument, and converts it into the *centrolinead*, which is used for drawing lines to a point or centre, situated at a great distance from the paper, and is extremely convenient for drawing vanishing lines in angular perspective. It turns on the centre c, and is set in any positon by the clamp screw, *e*. Fig. 2 is an instrument for dividing circles into a great number of equal parts, which is very useful for laying out the teeth of wheel work, and for many other purposes. A A is a brass circle having a cross-bar *a* immediately behind the centre, in which is fixed a screw *b*, with the end formed to a small point which enters the paper, making a small puncture and on which the circle revolves.

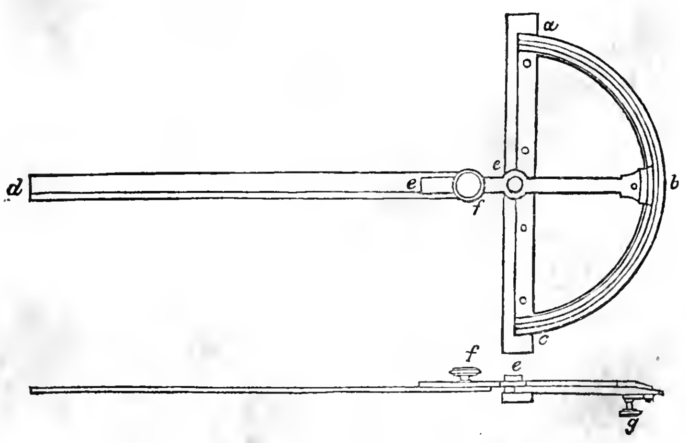
Fig. 2.




The instrument has several circles described on it, which are accurately divided by an engine, holes being drilled through the plate at any division. The number of these circles is not fixed; but eight will generally be found sufficient, each containing a different number of holes or divisions; thus the outer one may be 360, then 100, 96, 90, 84, 72, or it may be divided to suit the fancy of the artist. An index *cd*, containing a steel point in the end, for transferring the divisions to the paper at any radius, is attached to an axis *ef*, by means of a thumb screw *g*. When the screw is loose, the index having a slit or groove in it, can be moved so as to bring the marking point nearer or father from the centre, according to the radius of the curve to be divided. The ends of the axis *ef*, are supported upon the points of two screws which pass through the projections in the bar *a*. A small spiral spring is twisted around the axis, one end being secured to it, and the other, to the slider at the centre of the bar. This, by its tendency to expand, raises the marking point from the paper as every division is pricked off; *n* is a flat piece of brass, on the underside of which are three small pins for confining it to the paper, and which

is held down by the fingers. A steel spring *lm*, is supported upon the end of the piece of brass *n*, having in its end a small detent or pin which enters the holes or divisions as they pass in succession beneath it, when the circle is turned round. The manner of using the instrument is this. Place the centre point on the centre of the circle to .e divided, then loosen the screw *g*, and push forward the index until the marking point in the end touches the circumference of the circle, and fasten the thumb screw tight. Now, placing the piece of brass *n* in a convenient position beside the circle, drop the detent in the end of the spring into one of the holes of the circle containing the proposed number of divisions, holding the piece of brass down by placing the second finger of the left hand upon it. The thumb of the same hand is to be placed on the rim of the circle, to move it during its revolution, and the fore finger on the tail of the spring for the purpose of raising it out of the divisions. The fore finger of the right hand is to press on the screw *b* to make the indentations on the paper, and in this way the circle may be divided very quickly with as great accuracy as it is possible to obtain on paper. The *protractor* is used for laying down angles, or for ascertaining the number of degrees in any given angles. There are three kinds, the *circular* or full circle, the *semi-circular* and the rectangular, the latter having its divisions made on the chamfored edge of a rule, and which are derived from the circle, and is made in this form, merely for convenience The *circular* protraction, is divided into 360 equal parts or degrees, which are numbered at every tenth degree each way from right to left and from left to right. The *semi-circular* protractor is similar to the former in every respect, except it is but half a circle. The protractor has sometimes connected to it a steel tongue like the blade of a bevel, it being used for plotting surveys, &c. A very beautiful instrument of this kind is made by Alexander Megary of New York. Fig. 3 is a representation of it.

Fig. 3.



*A b c*, is a semi-circle of brass, having a bar *b e* of the same metal turning on a pin in the centre *e*. This bar has a verneer at *b* and a screw *f*, for confining the steel ruler *f d* to it, which may be taken off for the purpose of packing in a box. A screw *g* is for clamping the bar in any position on the semi-circle. *Protractors* are frequently made of horn on account of its transparency, but as they are very liable to warp they should be put into a book when not in use. An explanation of every method of using the protractor would be supurfluous, as the very sight of the instrument conveys to the mind at once the intention of it. The particular application must be left entirely to the artist, who after a little practice will make himself perfectly familiar.

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## HINTS ON THE ECONOMY OF HEAT,

### AND ON REDUCING THE CHANCES OF HOUSES BEING BURNT.

Many distressing cases of fire are known to originate from stove pipes, and flues of furnaces; also from sparks coming in contact with wearing apparel, and other combustible substances. Now, if the number of stoves and fire places could be greatly reduced, a corresponding diminution of these conflagrations would necessarily be the consequence.

The question which naturally suggest itself, is, how can we dispense with our stoves and fire places? I answer, pull down your chimneys, and place them under your streets in a horizontal position, three feet or more below the surface of the ground, there let them serve as conduits for hot air. The air may be heated at an establishment located near some navigable canal, or good land conveyance, where fuel can be had at the cheapest rate; let the air be taken from the most healthy spot, heated, and forced along these subterraneous tubes, by a steam-engine or other adequate power, and supplied to the inhabitants as water or gas is now done.

The next inquiry will be, how shall we prepare our food, and practice those arts which require fire in that performance?

Most of our large towns have grown up by degrees; the houses and streets have been formed to suit the tastes or circumstances of the owners; and not according to any general plan judiciously made. If a town or district were built upon a plan, that should be made and strictly adhered to, I think it possible to make such a town more exempt from fire, and much more economical in other respects. Let us picture to ourselves a plan for a town as follows. The dwelling houses to be built without chimneys or fire places; the heat, when required, to be supplied by the town, or by private companies, as might be found best. At the back of every house a kitchen, having a fire place, should be built, and any other outhouses or sheds that might be wanted. The back door might be covered with sheet iron on the side towards the kitchen, to prevent

the fire communicating to the main house, in case the kitchen or sheds were on fire. The fronts of the houses should face each other. We should then have alternately a front and back street. This would be a convenience, as the front streets would be exempt from some things which are disagreeable.

With respect to mechanics' shops, these should be built, and stand unconnected with dwelling houses. Much economy would result from this. A number of mechanics having shops near each other, might unite in the employment of a steam engine, to drive lathes and other machinery. If the various branches were carried on in the vicinity of each other, much time might be saved, both to the mechanics and their customers. Several mechanic locations might be distributed in different parts of the town.

The plan of the streets is of much consequence in finding a fire, when an alarm is given. I was once struck with the admirable plan of a spiders's web. The animal keeping watch in the centre, how easy it was for him to start in any direction, that an unlucky fly might get entangled in his net. I thought at the time, this would be an excellent plan for the streets of a town; with a watch tower in the centre, and a depot for fire engines, together with a market and other establishments requiring a central situation. Every district might also have its fire engine. By keeping a good look-out of a night, the direction of a fire might be quickly ascertained; and an index that swivelled round might point towards the fire. It might be elevated or depressed to indicate whether the fire was increasing or diminishing, or the town might be divided into sections, and the number of the section, where the fire was, presented alternately to all the radiating streets; so that any person wishing to know the location of a fire, would have but a short distance to walk to get at one of these streets, and but little time to wait if the index was kept revolving before he could satisfy himself.

Having thought considerable on this subject, I can conceive of some difficulties, and there are many arguments in its favor, which I may give at some other time. Perhaps some of the correspondents of the Young Mechanic will favor me with their objections.

PHILO.

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## MEMOIR OF A MECHANIC.

[Continued from page 120.]

I MENTIONED that my father could neither read nor write. He was very fond, however, of hearing all his children read; indeed, he made it a practice to hear us read the scriptures after dinner every Sunday. He sometimes had letters to write, most of which during my apprenticeship fell to my lot. At first he used to dictate what he wished to have written; afterwards he only gave me a general

idea of what he wanted; and left the rest to my discretion. The neighbors would occasionally get me to write for them. This gave me confidence; so that, although a bad writer to this day; I have not been very diffident at putting anything with which I was acquainted on paper. I feel more than ever the benefits of thus early attempting to write short epistles, or essays. Having some acquaintance with the periodical press; I know the difficulty of getting young men, not only among mechanics, but in all classes, to communicate what they know. They have leisure enough, but the task is too hard, because they have never been used to it. I had considerable patience with any thing that I undertook willingly. For instance, my father borrowed a book containing two sermons, a prayer, and some other short pieces. He was very fond of it, and did not know how to get a copy. I offered to write a copy of it, if he would find the paper. This occupied my leisure time for several weeks, but I finished it in spite of the jokes of my companions, for it was no easy matter to turn me from any thing I had set my mind upon.

I had some taste for drawing but found it difficult to make much progress, situated as I was. Gaudy pictures were much more easily made than correct representations; however, by perseverance and having a better chance as I grew older, I succeeded in mechanical drawing to my wishes; and also, tolerably well in the ornamental department.

From what has been said it might be thought, that I had always business enough on hand to keep me from mischief. I have sometimes, however, engaged in the excesses common among young men; but soon there would be something disagreeable happen; when I would return to my more innocent, as well as more profitable amusements. I used to be glad when a holiday occurred, for then I could do more than in many evenings. Thus, my seven years apprenticeship passed away. I served my time out 'duly and truly,' and my master gave me ten pounds with my indenture. He asked me what I was going to do. I told him I was going to London. 'Well,' said he, shaking my hand, 'Keep your right hand forward, and you will do well.' I had been vaccinated with the kine pox for the occasion, as a preventative against the small pox.

I arrived in London in April, 1810. Here many new scenes were presented to my view. In such a place, among so great a variety, it is difficult to confine oneself to what is most beneficial. My habits were fixed, however, and I adhered to my former plans. It should be understood, that I had been bred up in a part of the country, where agriculture is the chief employment of the people; that I had seen very little of manufacturing, or of machinery; in fact, I had never seen a steam engine, or heard a lecture on any branch of science, or seen a book on any subject connected with the arts or sciences, except one on Geography borrowed for a short time. Such was my situation when I visited the metropolis. I obtained work immediately; and here I may observe, that to this day, I

have never been without regular employment, except when I travelled for my own pleasure; nor even then, but for short periods. It was nearly two years before I adopted any regular system of passing my leisure time; most of which was spent in visiting places of note, or objects of curiosity. About this time I procured a good lathe, and other tools, and also a wife to assist me.

Having now a home where I could amuse myself in my own way, I pursued from this time a regular course; sometimes making various mechanical contrivances—at other times I practiced drawing. The latter is very good amusement for a young mechanic. It helps him to understand what he reads, as the engravings in books become easy to his comprehension; it also habituates him to nice observation, assists his memory, and is the cheapest amusement that I am acquainted with. It makes very little noise or dirt, and by having things portable they may be got out or packed away in a short time. Drawing is more or less useful to all, and is essential to the successful practice of some trades.

I was employed in a large machine shop, among men from various parts of the country. In such a place many valuable ideas may be picked up, but great care is necessary; for there are so many erroneous notions prevailing among workmen generally, that a young man may easily be led astray. An error among many of them was, a belief in the possibility of finding out the perpetual motion, or self-moving machine. I was for some time laboring under this delusion, and spent much time in the pursuit of what I am now perfectly satisfied cannot be accomplished. My first attempt was to make the descending side of a wheel heavier than the ascending side, by causing moveable parts to approach and recede from its centre; but let me modify it how I would, there always were a greater number of those moveable parts on the ascending side; so that, although they were made to recede further from the centre after passing the top, they were fewer in number on the descending side, and the wheel would turn as well backwards as forwards. Many other methods were tried, and some of them with fluid matter. A syphon was made with the short leg much larger than the long one, that it might contain a greater weight of water, and over balance that in the long leg; but I found it was necessary that the discharging end should be lower than the surface of the water in the vessel, whatever might be the form of the syphon. To detail all the experiments made would occupy too much space; the above are selected as fair specimens.

I can hardly tell whether the following whim of mine is worth relating. A young man made a box trap for catching mice, and was showing it as a specimen of his ingenuity. 'Now,' said I, 'if you had made it so, that after the mouse was caught, he would set the trap ready for another, and then go and drown himself, it would have been worth something.' He exclaimed, 'That is impossible! that is more than you can do.' I told him I would produce one in a fortnight's time. And so I did; and after that

another more simple than the first. These mousetraps were pronounced to be the greatest curiosities in my collection, which was coniderable. The first trap consisted of a box, open at one end, and a wire grating at the other. When the mouse entered the trap, and began nibbling the cheese, the door at which he entered would fall down. There was a hole in the side of the box, on pushing his way through which he raised the end of a lever, and started some clock-work placed on the top of the box, by which the trap was set again; while the noise of the wheels so startled the little fellow, that he would run up inside a spiral wire tube, into a jar of water before he was aware of it. In the second trap, instead of the clock-work, it was set again by the mouse turning a hollow wheel like a squirrel cage. It was so contrived that after entering this wheel, he must either work or stop there, but the instant he set the trap, a little door opened on one side of the wheel, when he would escape from it, to be let down by a trap door into the water.

I have now arrived at what I consider the most important period of my life. Up to this time, I had no instruction (after leaving school,) but what I could get in a very uncertain and precarious manner; and was just turned of twenty-five years of age, when I happened to see a notice of a course of lectures on Natural Philosophy and Chemistry. The names of the subjects to be treated on, such as Pneumatics, Hydrodynimics, Arostation, &c. were all Latin to me. On further examination, I found under the various heads, some account of the experiments illustrative of engines, and other things that I wished to be acquainted with. I bought a ticket, and was so pleased the first time; that I took notes of the lecture, and some sketches of the apparatus, (for I was seldom without my pocket book and pencil.) On returning home, I sat up very late, to write all that I could remember of the lecture. I continued to attend these lectures weekly from October 1815 to April following, taking notes of all that was of importance to me. In the following summer I procured a book on Natural Philosophy, which contained an account of the various things I had seen in the lectures. I also made many articles with which I tried experiments; and succeeded so well as to be induced to attend a second course of lectures, besides several others given by different persons. At length I applied for membership to a Philosophical society, but not having friends enough at court I was not received. This did not turn me aside from my pursuit, but stimulated me to use all my efforts to improve the class to which I belong. No! it made me redouble my exertions, I reasoned thus: I am a mechanic—that is the difficulty. Well! suppose the mechanics should be invited to form themselves into a society for mutual improvement. This was suggested to a few persons, and with their approbation I got a circular printed, and distributed it, inviting those who felt the want o information to come forward. A society was formed, which lasted about three years, and finally dwindled away; leaving the few persons who began it in

possession of what books and apparatus had been procured. It is astonishing, but it is true, that the great mass of mechanics do not appreciate knowledge as they ought to do; they do not go forward themselves, and can hardly be persuaded to partake of the repast after every thing is prepared for them; so that it becomes those who have drunk at the fountain of knowledge, and known its efficacy, to go forward and do all they can for its general diffusion; for there is nothing that we could do, that would have so great a tendency to alleviate the miseries that are felt by the great bulk of mankind.

(To be continued.)

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## PORTLAND MECHANICS' LYCEUM.

In the latter part of 1828, a few young men, apprentices, incidentally met, and during their conversation, remarked upon the utility of improving the intellect; and before parting, it was thought best, if a convenient room could be obtained, to form a class and commence studying some one of the most useful branches of education. For some time this object laid in suspense, and nothing was done but talking. At length one suggested the idea of forming a society of young Mechanics, for the purpose of mental improvement, to have connected with it a Library, who drew up a preamble, with some regulations. These were submitted to the rest, who approved of the measure, and were willing to engage in the undertaking.

The preamble and regulations thus drawn up, being rather defective, all heads were set to work for the purpose of making something that would better answer the end in view, and which would be more likely to engage the attention of those for which the society was designed. About a dozen were written, each at different intervals, till at length one was produced which appeared to answer, and which briefly set forth the objects intended. So much writing and talking necessarily retarded its progress, and it was not until the latter part of March, 1829, that the preamble was fully accomplished and ready for subscribers.

On Saturday, March 31, 1829, an apprentice having had his stent and gained the afternoon, took the paper, and volunteered his services to go to the work shops in town and inform the younger class of mechanics of the meeting intended to be held that evening. He also invited those who seemed interested, to sign the preamble. The result was, that at night the list numbered forty-four, mostly apprentices, none advanced of 25. The meeting that evening was large and respectable. The business was transacted with the strictest decorum. The most important was that of choosing a committee to draft a Constitution and By-laws, to effect the objects laid down in the preamble, which were, the acquisition of knowledge and the promotion of temperance, together

with the forming of a library. This latter clause occasioned the appointment of another committee, who were to report the best possible means whereby one might be established.

The committees thus raised were faithful to their trust. A very good Constitution was adopted, with a respectable code of By-laws. The Society then took the name of Franklin Association. The report of the Library committee, among other things, recommended the appointing of a committee to wait on the Maine Charitable Mechanic Association, to procure, if possible, the loan of the Apprentices' Library. This committee was raised, and did the duty assigned them; the result was favorable, and the loan obtained, a proviso being made, that while it should be in the hands of the new society, it should be well taken care of, and that the Library room should be opened on Saturday evenings for the loaning and the receiving of books. The Mechanic Association manifested much interest in the new society, and reposed great confidence in it. They also liberally voted to expend the sum of twenty dollars annually for additional books. This Library at present numbers about 1400 volumes, and has continued in the hands of the Lyceum ever since.

At the formation of the society, each person, agreeably to the Constitution, on signing it, was obliged to present the society with at least one bound book, to be approved of by the Directors. This course has been followed to the present time. Besides the books given by members, some of the funds of the Lyceum have been appropriated for more valuable works.

Towards the close of the first year of the existence of this Society, it nearly fell into oblivion. The meetings for transacting the most important business were rarely attended by more than a dozen members, and but one or two of the objects for which the society was formed had as yet been accomplished. It was therefore found necessary by the few most interested, to do something without delay to revive it.

A very judicious course was adopted. A member was appointed to deliver an Address on the annual meeting, which was near at hand; public notice of which was given through the newspapers. This meeting was well attended. Both sexes were present. The Address was much to the purpose, and well calculated to instil new life and energy into the members. After the Address, the clergyman who was invited as chaplain, rose and addressed the members of the society in a very appropriate and encouraging manner. The audience then retired, and the society proceeded to business, of which some of importance was transacted; such as adopting a new Constitution and By-laws, and the raising of a committee to take into consideration some of the measures recommended in the Address. This committee reported at a subsequent adjourned meeting, in favor of forming within the Association a school for mutual instruction, in which, for the present, only writing and grammar should be taught, and of each member having the privilege of introducing a female friend. This report

was accepted, and the school was soon formed and put in operation; and at various periods afterwards, different studies were pursued. Soon after the annual address several influential and persevering mechanics joined the society, who did considerable for its advancement; and from that time to the present year the societyhas been flourishing.

The school continued until early in the spring of this year, when by a vote of the society it was suspended. While the school was in operation much improvement was made by the scholars, and much advantage reaped by the members.

Shortly after the organization of the school, one evening in the week was devoted to reading and debates; and at a more subsequent period an evening in the week was allotted to declamation, and at a still more recent period, a Court was established in the Lyceum for trying members for any misconduct of which they might have been guilty. During the whole period since the formation of the school, the society has had occasional addresses by different members, on quarterly meetings, agreeably to a proviso in the Constitution.

In December, 1830, a third Constitution and code of By-laws were adopted, in substance the same as the former two, but more preferble, and the name of Mechanics' Lyceum in lieu of Franklin Association adopted. This name was thought to convey more strictly the objects of the society than the other.

During the winter and spring of 1831, a course of lectures on Natural Philosophy was delivered before the Lyceum by several of its members. This course embraced the general topics of that science, as usually laid down in works treating upon it. The lectures were well attended, and fraught with much instruction.

At the commencement of the spring of the present year, the Lyceum took a vote to invite several professional men to lecture before them on scientific subjects. These lectures were delivered on Tuesday evenings of each week throughout the spring; and during the course some of the members also rendered their services by occasional lecturing. Considerable interest was manifested in this course; the lectures were well attended both by members and citizens. On some occasions, the house was filled to overflowing.

Since the above course terminated, the Lyceum took a vote to suspend the school, lectures, and meetings for debate and declamation, until the latter part of this month; and the Board only is now in operation, which consists of the President, Secretary and six Directors, who hold meetings on Saturday evenings at the Library room, after the business of the library is finished. The board of Directors, exclusive of the President and Secretary, is elected by ballot quarterly; they act as librarians. The President and Secretary are chosen annually. The whole Board transact the minor business of the society, such as the admitting mechanics as members, &c. They also compose a vigilant committee, to see if any member is guilty of any misconduct, or of violating any of the

regulations of the Lyceum. It is their duty also to select subjects for debate, when questions are to be discussed, and to appoint disputants; to appoint persons to speak pieces or read; in fact they have a general superintendence of the affairs of the Lyceum.

It is expected that early this fall, the Lyceum will again resume her wonted station—that the various departments which, since its existence, have been the instruments of diffusing so much useful information among the mechanics of this place, will be opened and entered upon with increasing energy. I trust, that as years shall roll onward, that class of society which the name of this institution designates, will, by their exertions, by improving their intellects and storing their minds with useful knowledge, rise from that state in which their own negligences have hitherto placed them, to a level with the most erudite and influential of the community.

S. H. C.

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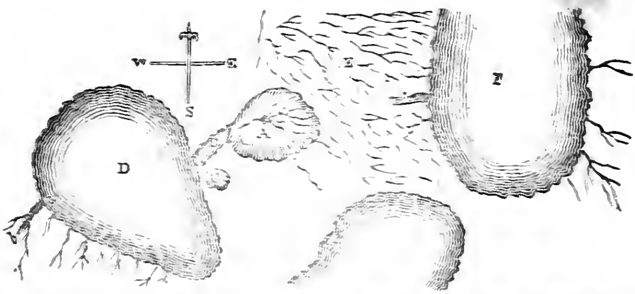
## LIGHTNING.

Messrs. Editors—While on a recent visit to Stoughton, I was shown among the curiosities of the place, one which I conceived would be acceptable to your readers, if a description could be given, at all commensurate, to the sublimity of the subject. It was the effects of one of those terrible discharges of electric fluid, which are seldom witnessed, and more unfrequently described. Although it is impossible for me to convey an adequate idea of the scene, yet some things connected with it, are so peculiarly interesting, that I cannot forbear to make the attempt. For the following description of the storm, I am greatly indebted to a friend who witnessed this grand but awful display of electric phenomena, and accompanied me over the place, pointing out the different courses which the fluid had taken, many of which were still visible, and aiding me inmaking the following sketch, which although imperfect, is sufficiently correct, to give the reader a better idea of its location, than could be given by writing alone.

On a sultry day, during the last spring, about 4 o'clock, P. M. the clouds began to rise extremely black and threatening, and shortly afterwards drove about in great confusion, from south west to north east, presenting appearances which have seldom, if ever before been witnessed by the oldest inhabitants of the town. In consequence of the increasing darkness, mechanics and farmers were unable to follow their business, and collected in groups, awaiting in suspense the product of the next moment. The clouds still gathered, and grew more dark and heavy, till at length two clouds from opposite points came in contact, and lightning was seen in every direction, succeeded by the most appalling claps of thunder; immediately afterwards another more dreadful than the first burst forth, and the atmosphere appeared to be filled with

balls of fire, which burst, making a hissing, like that of a hot ball thrown into water, accompanied with a report like a pistol.

Soon after the storm, it was reported that the lightning had struck near; my friend among others repaired to the spot, which was in the woods about a quarter of a mile from any house, and the scene which he describes was truly desolating. The fluid appears to have struck a large pine tree about 60 feet in height, situated in the seam of a ledge of granite A, which rises about 8 feet from the surrounding surface of the ground. The branches were entirely stripped from the S. W. side of the tree by the fluid, in its descent to the rock, where it separated into nine branches, each taking a different direction, breaking off pieces from the ledge in their courses, and throwing them about in every direction, some weighing several hundred pounds. The principal branch running south westerly, after leaving the rock entered the ground, forming a channel in its course more than four rods in




length, 8 feet in width and 7 in depth, which is represented at B. The earth from the channel was thrown up with great force, almost covering the surrounding trees for several rods. One tree about three inches in diameter (which grew where the channel was made) was thrown 25 feet high, and lodged in the top of a larger one, where it is still to be seen. C is a large rock 3 feet in diameter, which was also thrown from the channel several yards, smaller stones and branches of trees were thrown two or three hundred rods. Its course was then interrupted by the water D, through which it went to the opposite side, and appeared in nine different places, making another channel at *a*, six feet in length, and one in depth. It then entered the ground obliquely and disappeared at *b*, leaving a hole five or six inches in diameter. The other branches, after spreading for some distance, as represented in the sketch, likewise disappeared.

The other primary streams, which started from the rock, continued their course in a north easterly direction, and spread over the field E, of about 15 acres, covering the surface with small channels branching in every direction. Here also meeting with the water F, it appeared to collect in two places at the edge, making (as if in fury at this interruption to its course) the channel *c* five feet in length, one in width, and two in depth, and then

bounded into the earth, leaving another hole similar to *b*. The remainder crossed the water and came out on the opposite side in three places, then branched into smaller channels, until it entirely disappeared.

I have thus confined myself to a simple and plain description, feeling conscious that to add to the grandeur of the subject, is beyond the power of words. Without entering more largely into the subject, or engrossing more of the patience of your readers, I will conclude, by merely giving one or two ideas which occurred to me while examining the situation of the place. There is no doubt, but that the discharge of fluid was very great, and would have produced incalculable destruction in a thick settled village. But Providence, ever watchful with an overruling hand, appeared to direct it to a very peculiar and favorable spot. The tree was pine and situated higher than any other in the neighborhood, and the fluid (being received among the innumerable points which compose the leaves, or foliage of this kind of tree) was probably weakened in its effects more than if the object had been a house or barn; for the same reason, that a Leyden jar when sufficiently charged with electricity, to give a powerful shock by applying a ball or blunt instrument, can be discharged with impunity, by presenting a needle instead of a ball. Another favorable circumstance was, in consequence of the thaws and rains during the spring, the place was nearly surrounded by water, which by being a good conductor, checked the progress of the main branch B, and distributed it so effectually, that little appeared on the opposite side, in proportion to that which entered. This assists in strengthening the position, that the discharge was very heavy, (if there was an absence of other proof) for the water D covered two acres, and yet was insufficient to prevent some of the fluid reaching the other side. I have no doubt, however, if the water had been deep, it would have been entirely checked.

The above is in the N. E. part of Stoughton, and extends about a quarter of a mile. J. M. W.

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## PATENTS FOR MASSACHUSETTS.

GRANTED IN FEBRUARY AND MARCH, 1832.

*February.*

For an improvement in the mode of *Cutting out Visors of Leather, and other materials, for Caps and Hats;* John Hoskins, Roxbury, Massachusetts, February 20.

For a *Cane Rifle;* being an improvement on rifles and guns. Roger Newton Lambert, Repton, Massachusetts, Febuary 27.

*March.*

For an improvement in *Harness Saddle Trees.* Philo Washburn, Bristol county, Massachusetts, March 8.

This saddle tree is to be made entirely of wrought iron. In

the middle, where it is fitted to the ridge of the horse's back, it is to be made quite narrow, whilst the sides are widened and flattened out. The terrets and water hook screw into holes prepared for them, and the tree, when properly padded, is complete. The claim is to the wrought iron tree, as a substitute for wood, it being more compact and stronger than that material.

For an improvement in the *Manner of supplying Steam Boilers.* Jesse Fox, Lowell, Massachusetts, March 14.

For *Machinery for Printing.* John Hatch, Boston, Massachusetts, March 21.

This is a new contribution to the list of power presses, the introduction of which has done so much in facilitating the typographic art. In a complex machine of this description, the parts are too numerous, and the peculiar combination which constitutes the essential characteristics of a new or improved machine, too dependent upon minute points to admit of their being given without drawings. To such particulars the claims made by the present patentee refer, and we therefore dismiss the subject, at present, without an attempt at description.

For an improvement in the *Mode of Spinning Wool*, for the manufacture of coarse or heavy fabrics, and particularly for ingrain carpeting. William Calvert, Royal Southwick, and Alfred Messinger, Lowell, Massachusetts. The former an alien, having resided here two years; the two latter citizens of the United States. March 31. *Journal of Franklin Institute.*

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## PROCESS OF MM. THENARD AND DARCET,

### FOR PRESERVING SUBSTANCES FROM HUMIDITY.

In a former number of the Young Mechanic, our correspondent J. M. W. inquires whether there is any simple but effectual means of preventing damp walls. Perhaps the following from the Franklin Journal will answer his purpose. EDS.

On the 27th of February, 1824, there was read at the Academy of sciences of Paris, a memoir, by MM. Thenard and Darcet, on the employment of fatty bodies, for making coverings and unalterable plasters, and for making moist places salubrious. This process, the effects of which have been established by several years experience, consist in causing a mixture of one part of oil, and two parts of resin, to penetrate, by means of an intense heat, either porous stones, or plaster. The bodies penetrated with this mixture, acquire afterwards a singular degree of solidity, and become absolutely impermeable to moisture.

This process may be employed, for rendering low and damp places salubrious. It was tried at the Sorbonne, and the expense of it was only 16 sous per square metre, or a square whose side is 29 English inches. The other objects, to which it is proposed to apply it, are houses, statues placed in the open air, bas reliefs and sculptures in plaster, the ceilings and walls of rooms intended for Fresco paintings, basins for holding water, and reservoirs for holding grain.

M. Thenard exhibited to the Academy, several objects of art, executed in plaster by his process. In order to show its efficacy, he exposed to the open air, for several years, a bas relief, half of which was formed of ordinary plaster, whilst the other half was prepared. This last half was perfectly preserved, while the other displayed visible traces of disintegration. This process does not resemble those which consist in covering bodies with a sort of skin, which keeps off humidity. The body is actually penetrated with the mixture, to the depth, sometimes, of several inches.

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## THE BEST METHOD OF PREPARING GLUE.

In the purchase of glue, it would be well to select it in warm, damp weather, for then if the oily substance has not been thoroughly separated in its manufacture, it will be soft like India rubber. This will neither dry nor hold well, and after being melted, will in a short time turn black and taint. The method I have adopted for improving glue, is to add a gill of vinegar, alcohol, or cider, when dissolving it in a common glue pot, and afterwards, as much water as necessary. Glue prepared in this way, will melt much quicker and hold the heat longer, than in the common method, and when used on wood, will dry much better and will not taint. The vinegar I think is best, as it does not evaporate so rapidly as alcohol.

JOSEPH.

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## ANSWER.

Messrs. Editors—In answer to a question in the Young Mechanic 'Can any means be used to put thin sheet lead on roofs so as to prevent cracking?' I would say, there can. As a proof, I refer to a roof at the Lead works, Roxbury. The lead is 3 to 3 1-2 lbs. per foot. It was done March, 1831, without nails or solder. Being brought up in England to the use and manufacture of sheet lead and pipes, I profess to know the nature of the metal, and feel confident of its use, to answer the end required. Had I the means, I could manufacture sheet lead, in a way that would remove the doubts of the most captious, as to its durability. In the question is the expression 'This changeable climate.' True it is so; but let allowance accordingly be made, for contraction and expansion; and knowing the medium and different temperatures we have to contend with the difficulty is obviated.

J. B. P.

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## QUESTION.

If two wheels be geared together, the larger having 127 cogs, and the smaller 21 cogs, it is required the number of revolutions of each wheel, before the same two cogs meet again.

JOSEPH.

THE

# YOUNG MECHANIC.

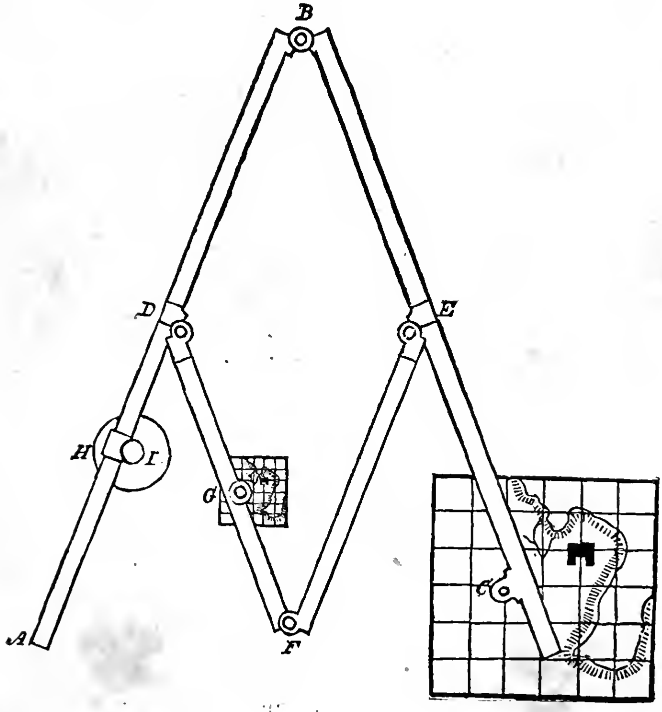
Vol. I. OCTOBER, 1832. No. X.

## OBSERVATIONS ON DRAWING INSTRUMENTS.

[Continued from p. 132]

### THE PANTAGRAPH.

Fig. 1.



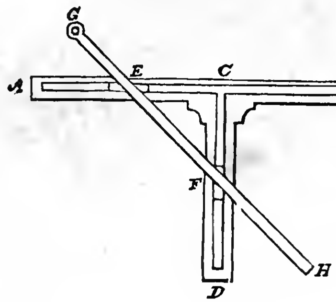
Next to the proportional and triangular compasses the *pantagraph* or *pantographer* is probably the best instrument by which the labor of copying a drawing is lessened; indeed by many it is preferred to all others. By it a drawing may be reduced or enlarged, or made to the same scale at pleasure, giving the lines with great exactness, however crooked and complex, which renders it very valuable, as there is no other correct method of obtaining copies of such lines. It is not known for certainty who was the inventor, but the earliest account which is found of it is in a book, published by *Scheiner* a Jesuit, in the beginning of the 17th century. The geometrical principles will be easily understood on inspection by every mathematician. Fig. 1. AB and BC are two thin rulers of wood, brass or steel, joined at B by a double pivot; DF, EF, are two shorter rulers united at F and attached to the long bar, by joints DE. The proportion of these rulers is not important but in the construction of the instrument; the four taken together must always form a parrallelogram, then EF in all positions will always remain parallel to AB. A small castor or wheel is fixed under each joint upon which the instrument rests, and which allows it to traverse freely in every direction. H is a circular leaden or brass weight, having on its under side, three small points for entering the paper, and on the upper a pivot on which the instrument turns, and which is the only stationary point in the instrument while in use. C and G are the two drawing points, the tracer and pencil being fixed in either, as the plan is to be reduced or enlarged. The three points IGC must be in a right line, and it follows from the construction, that they will continue so in every situation, and will divide its length in the same proportion as first fixed. They must be so placed in regard to each other, that the distance C G will divide C I in the proportion in which it is intended to reduce the drawing. A blunt tracer being fixed at C, can be passed over all the lines in the original, while at the same time, the pencil or ink point G makes the copy. The pencil point has generally attached to it a cup, into which shot or other substance may be put to regulate the strength of the mark. A small string is sometimes used for lifting the pencil from the paper, if any irregularity should occur in the marking. The instrument should always be used on a very smooth and plane surface, or their points by the flexibility will be liable to be thrown out of the perpendicular. If the instrument should be too small to extend over the whole of the drawing at once, two or three points may be marked in the original and corresponding ones on the copy; the instrument may then be removed and the sheets of paper placed in such situations as to admit of copying the rest, and by this way of proceeding a plan may be copied of ever so large dimensions.

## *Of Instruments for describing Ellipses.*

Of the many instruments for describing this curve none probably are so universally useful as the common *trammel* or elliptic compasses. An instrument of some kind for this purpose is indis-

pensably necessary to the artist, if he draws in perspective or projection. The trammel has many defects which renders it rather inconvenient at times. Fig. 2 consists of two pieces of

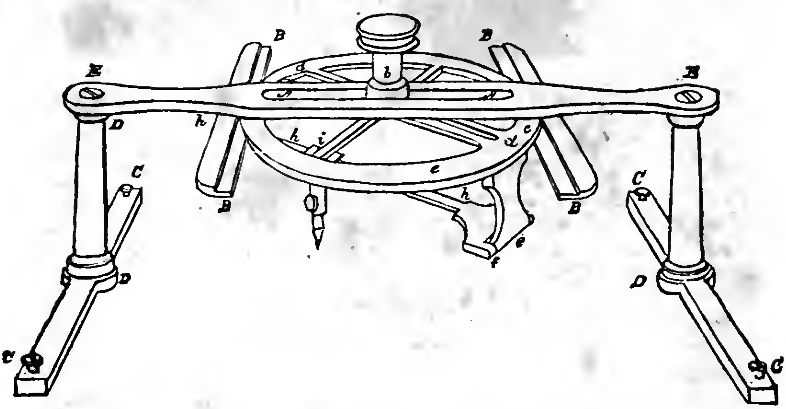
Fig. 2.




brass AB, CD, at right angles to each other in which are cut two dovetail grooves to receive two small sliders E F, which are accurately ground in them, and move freely without any shake or looseness. A small hole is made in the centre of each piece to receive the ends of the pins which project downwards from the sliding sockets on a small beam of brass or steel GH. In the extremety G of this beam is fixed a small tube containing the pencil or ink point. The cross has four small points on the under side to confine it to the paper, and suitable marks on the ends to set it over the centre of the intended ellipse. The rule for setting the point is to make EG equal to half the transverse diameter, and FG to half the conjugate of the ellipse, and by turning the beam the two slides will move in their respective grooves and an ellipse be produced. The instrument in its present form cannot be used for drawing small ellipses, or very narrow ones, as the drawing point will interfere with the arms of the cross and the two centres cannot be brought sufficiently near each other. For these reasons the instrument is totally inapplicable to small ellipses.

Fig. 3 is an instrument called *Elipsafex*, by which ellipses can be drawn on paper with great facility and exactness, by merely making a right line for the transverse axis, and laying the centre of the instrument over this. If the centre screw is placed in its greatest, or indeed any eccentricity, and the pencil immediately under it, the pencil on turning the wheel will be found to describe a right line. If on the contrary the centre screw is placed on the centre of the wheel, the pencil will describe a circle which may be diminished down to a point without making any centre mark, and hence the instrument is capable of describing every proportion of an ellipse between a circle and right line. Fig. 3 is a general view of the instrument, consisting principally of a frame, wheel, and arm carrying the pencil tracer or pen. EE is a horizontal beam, having a groove AA cut in it, and being fixed to the tops of the supports, ED, ED, BB, BB, are guides, each consisting of a brass bar and a steel plate attached to the horizontal bar EE.

Fig. 3.




The straight edges BB, BB, of the steel plates should be parrellel to the feet CC, CC, or to the table. *c* is a wheel grooved on the edge so as to fit and slide upon the steel plates BB, BB, and to move freely and exactly thereon, so that the centre of the wheel may be compelled to describe a straight line parallel to the drawing board. The arms of the wheel are at right angles to each other, in one of which is a groove *dd*, in which is inserted a slide made to fit the groove exactly and to move freely therein. *b* is a screw with a milled head made to fit the groove AA, and tapped into the slide so as to fasten it in any part of the groove AA. A vertical piece of brass *ee*, to which is attached the arm *ehh* by a joint, projects downwards from the wheel. The arm has a slider *i*, with a tube or case connected to it, which carries the pencil or tracer, and which by means of the clamp screw may be fixed on any part of the arms. In adjusting the instrument the two grooves AA in the beam EE, and *dd* in the wheel, should be brought underneath each other so as to be in one straight line; then make the distance of the tracer from the centre of the instrument equal to the semi-conjugate axis, and move the screw *b* so that the distance between the point of the tracer and centre of the screw shall equal the semi-transverse axis. By turning round the wheel the screw *b* moves backwards and forwards in the groove AA by the eccentricity of the circle, and the ellipse is described. Many other instruments for the same purpose have been invented by Farey, Clement and others, which are very complex and costly, for a description of which the student is referred to *The Transactions of the Society of Arts.*

# MEMOIR OF A MECHANIC.

[Continued from page 137.]

In June, 1820, I left London for St. Petersburg, in Russia; at which place I arrived in eighteen days. I was sent out with apparatus for the production of gas from oil, for the purpose of illumination. We left the ship at Cronstadt, and proceeded to the city in a steam boat. It was about eight o'clock in the evening when we came in sight of St. Petersburg. The sun was rather low. His rays had a fine effect on the bright steeples, and splended domes of the public buildings, all shining with a metallic lustre, so that, for the distance of five or six miles we had as grand a sight as I ever witnessed. It was light enough to see to do ordinary work out of doors, all night for several weeks after I arrived. I remained three years in this city, and could say much about the place and the people, but must confine myself chiefly to mechanical operations. It is astonishing to see the variety of work a carpenter there will do with his axe only; it answers for the saw, hammer, rabbit plane, shave, and in some cases for the chisel. At his meals, he cuts his black bread with it. The fore plane which they use, has four handles. It takes two men to work with it. They sit on a pile of boards planing that which is uppermost; one man pushing while the other is pulling the plane. The joiner uses a saw in a frame, somewhat like those used by the wood sawyers in Boston. The masons build their walls very thick. Their stages are ascended by inclined planes, instead of ladders, so broad that one might drive a carriage up them with ease. The mortar is carried by two men on a kind of hand barrow. They walk up these gentle slopes very leisurely. The bricks are carried by one man. He takes a piece of board two feet long, with four projecting pins, or arms, two of which rests on his shoulders, while the board hangs down his back; the other two pins are for the bricks to rest upon. He carries about sixteen bricks at a time. The fronts of the houses are white-washed, and their tops covered with sheet iron, and painted.

Fig. 1.

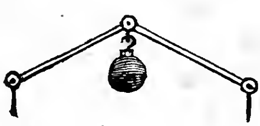


Fig. 2.

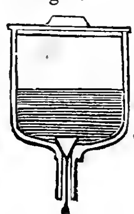
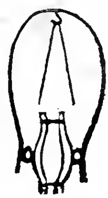


Fig. 3.



Lord Bacon observes, that when we travel into foreign countries, we should not adopt every new thing we see, but now and then prick in a flower. Following his advice, I will describe three things which appear to be useful, and peculiar to this place. At least I have not seen them anywhere else.

Fig. 1 represents a contrivance for shutting doors. The power is applied in the same manner as in our modern printing presses. There is a pin at each end of the apparatus. One pin is fitted to and turns in a socket attached to the frame, and the other fitted to a similar one on the door. In opening the door the pins are brought nearer together, and the weight in the centre is raised. The door is shut by this weight straightening the bars and spreading the pins further apart. Some of these articles are made of iron and black, others are of brass and kept bright. They are extensively used. Fig. 2 is a cistern for water, with a valve in the bottom, which is much used for washing the face and hands. By raising the valve the water is let down in small quantities, and as it is used passes off by means of a sink placed underneath. The advantages of this method are, that persons do not wash in the same water with others, nor use it more than once themselves, which is not only more conducive to health, but makes less water necessary than the washing in a common bowl. These cisterns are made of various forms and sizes. Some of them have a dozen or more pipes, each furnished with a valve, so that many persons may wash at the same time; the large ones are made in a circular form, and placed in the middle of a room, but the small ones are hung against the wall. In Fig. 3 is represented a spring bow or arch. This is used with the horse-collar, for the horse that is placed in the shafts. Other horses do not have them. It was a long time before I could see any other use for this contrivance, than to cause the horse to hold up his head, and to keep him from stumbling by the bridle being hooked to the top of this arch. I was informed afterwards by an intelligent man, that the spring being connected with the collar, prevented the shoulder of the animal from chafing by continually easing the collar off, and suffering the air to pass between that and the shoulder of the horse.

Generally speaking the Russian workmen do very well. As there has been great encouragement given to strangers, many have settled among them who have improved their manners. Their manufactories of iron, and of goods from hemp and flax, have been long celebrated. They have also carried the manufactories of paper, cotton, silk, and glass, to considerable perfection. Granite is much used in their public works, for foundations of buildings, lining the canals and rivers, and for side walks. Some of the columns made of granite are very large, and highly polished. I took the pains to measure one of the columns intended for a new church, and found it fifty six feet long, and six feet six inches diameter at the base. They were brought from Finland. Two of them were a load for a ship, one on each side of the masts to ballance each other. They were rolled from the deck to the vicinity of the intended building on timbers nine inches square, placed but little distance apart, which were completely crushed to splinters. The rolling was performed by two ropes; one end of each was made fast some distance ahead, to stakes driven in the ground. They were passed under the column up the back side, and over

the top. The other end of each rope was wound round a separate capstan. Each capstan had four long levers, with from ten to twenty men at each lever. These columns were placed in a temporary building for polishing. I also visited the foundry where the bases and capitals were made. They were of brass of the Corinthian order, and highly polished and gilt. The square plinth for the bottom, was about nine feet on each side and one foot thick. Several women and children were polishing these with pumice stone. The torus, a round bead belonging to the base was turning in the lathe. The man had a very strong tool for this purpose. A steam engine, with a man to attend it, was employed entirely on the work. The capitals, with their leaves and volutes, had a very splendid appearance.

The building in which I was engaged in putting up the gas works, was for transacting the business of the Russian army. It was built in the form of a crescent, having a large arch in the centre. It was situated opposite the imperial palace. The area between these buildings was used as a parade ground for the soldiers every morning. In this building were several departments, with a general at the head of each, some of whom employed over two hundred clerks. The library was very extensive, in the centre of which we put up a splendid chandelier, which cost four hundred pounds sterling in England. It had three hundred and sixty jets of gas issuing from a circle of brass seven feet in diameter, above which were four eagles lit with gas. There was also a great quantity of richly cut glass about it. In this building I saw lithographic printing for the first time; copperplate and letter press printing were carried on here, and a very extensive establishment for the manufacture of mathematical instruments, all belonging to the government; likewise a drawing school, consisting of about two hundred young officers.

The Academy of Arts is open to the public once in three years. I had the pleasure to spend several hours in examining some of the specimens of painting, sculpture, &c. in the rooms and corridors, but they were so numerous as to require months instead of hours to examine them properly; the corridors alone are said to extend more than a mile in length. Although this building is devoted chiefly to the fine arts, there are many specimens of mechanical skill. I noticed a model of the machine, on which a large block of granite weighing upwards of nine hundred tons, was removed several miles. Peter the great is said to have stood on this rock, giving command to his army, when he subdued the Fins. The empress Catherine ordered it to be removed to the city, for a foundation, on which is placed a bronze statue of that Monarch on horse back. Many ineffectual attempts were made at its removal; but it was easily performed afterwards by introducing cannon balls for rollers between bars of iron.

The most splendid specimens of art that I remember to have seen, were in the emperor's Hermitage, which is attached to the Imperial palace, and is a place of retreat from the busy scenes of

the court. In this building are many splendid rooms, the walls of which are hung with the most costly paintings, by the first artists in every country, that could be procured by money or otherwise; several delicate specimens of sculpture, and models of architecture; with a variety of curious articles made of gold, silver, and ivory; in fact, nearly every material is here to be found fashioned into something either useful or amusing. The splendid jewels belonging to the emperor are kept here, and a great variety of gold and silver coins and medals. Some of them are very ancient. There is also a cabinet of minerals, and a collection of rare books. One work appeared to consist of about eighty thick folio volumes, and to be placed there more for show than any thing else. These rooms form a square; in the interior is the winter garden, kept warm and comfortable. There (let it be ever so cold and dreary without,) is to be found thriving plants and singing birds. Directly over this is the summer garden on the top of the building, and to complete the variety there is a small theatre, with seats in a circular form, which I thought would be a good model for a lecture room. Among the specimens of the mechanic arts, were two large vessels, seven feet in diameter, one of richly cut class, and very massive; the other was of jasper, and about the same size and pattern; they were wrought in the country, and presented to the emperor as rare specimens of skill.

There are other palaces in St. Petersburg, and several in the country within thirty miles of the city. Some of them have very fine gardens laid out with great taste, the walks of which are very pleasant; for nature and art have been used to the utmost to make them so. Many marble statues are placed in the gardens, and appear to have been brought from the ruins of ancient cities. The gardens are frequently enlivened with bands of music. The summer palace at Tsascocella was the most popular, having been the favorite retreat of Alexander. In these gardens are many curiosities, among which is a complete chinese village, with cottages, bridges, and temples; but the thing that pleased me best, was a spring of water with its embellishments. It is situated in a valley, well shaded with tall trees. The approach to it is rather gloomy; but when you reach the spot an open space appears. The spring is on one side; and on the opposite side are seats placed in a semicircular form, where you may rest yourself. The water issues from a broken pitcher, which appears to have just fallen from a young lady's hand; which is a remarkably delicate piece of work in bronze. It consists first of a pedestal, on which a beautiful young female is reclining, supporting herself with the left arm. In her right hand is the handle of the pitcher. The pitcher itself lies on the pedestal, and overhangs the front edge enough to prevent the stream of water from touching its base. Her eyes are fixed on the pitcher, and she appears to look so earnest, and so composed that if she could speak, I should expect her to say, coolly, It is done, and cannot be helped.

It will be readily imagined how my leisure time was spent while

residing in this city. It was spent in studying the Russian language, drawing, and mechanical amusements in winter time; and in summer, visiting places of note, and observing the manners and customs of the inhabitants.

(To be concluded in our next.)

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## BOSTON MECHANICS' INSTITUTION.

This society was formed by the exertion of a small number of practical mechanics, near the close of the year 1826. Desirous of obtaining for themselves, and the citizens generally, a more perfect acquaintance with the common principles of science, particularly those immediately connected with the useful arts, they united in an association for the attainment of this object in the most direct and efficient mode within their reach. It was at once perceived that instruction could be more easily and generally diffused by means of lectures than in any other way. Arrangements were therefore made for obtaining, immediately, a few lectures on some branches of mechanical philosophy and chymistry, to the members of the institution, to which persons of all professions were elligible. On the public announcement of this design a great number of individuals joined the institution, and it was opened with an address by the Corresponding Secretary on the 7th of February, 1827. The subsequent lectures of the season were attended by 450 members, and 77 minors.

This encouraged the Board of Managers, to whose care the government of the institution was committed, to attempt the collection of an apparatus for performing the experiments necessary to a clear illustration of the subjects of physical science. For this purpose a subscription was opened, and in a short time about $1,150 was subscribed, principally by wealthy citizens, in sums of from 10 to $200.

The collection of apparatus thus commenced has since been continued to the full extent of the means of the institution, and consists, at present, of a beautiful working model of the steam engine; a large air pump, and all the necessary pneumatic apparatus; complete and well excuted models of all the mechanical powers; a complete model of a water wheel, and models of a variety of hydrodynamic apparatus; a carriage and several models of railways; models of various other apparatus capable of illustrating important elementary truths in mechanics, and the useful arts.

In the summer of 1827, an act of incorporation was obtained from the government of the commonwealth, and the lectures of the following season were delivered at the hall of the Athenæum, to 544 members. As a greater number of persons than this could not be accommodated with seats in the hall, the Managers were unable to issue any tickets for the admission of minors. Arrangements were made, however, in the summer of 1828, for the repeti-

tion of the lectures, which should be delivered in the succeeding winter, to a class of minors, and the instruction was thus extended to 240 young persons, principally apprentices and students preparing for active life.

The lectures were repeated two seasons; since which time that measure has been unnecessary, owing to the number of kindred societies that have been established since the formation of this. The Mechanics' Institution still maintains an elevated rank. The Managers have made arrangements for the admission of minors, and also for that of Ladies, the coming season. The lectures will be delivered at the Temple Lecture Room.

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# INDIAN METHODS OF WORKING IRON AND STEEL.

From the Transactions of the Society of Arts.

## ON THE DAMASCUS GUN BARRELS.

The gun-barrels made at Bombay, in imitation of Damascus, so much valued by the Orientals for the beauty of their twist, *are manufactured of iron hoops, obtained from European casks, mostly British.* The more these hoops *are corroded with rust*, they are proportionably acceptable to the workman: should there be any deficiency of this necessary oxydation, they are regularly exposed to moisture, until they are sufficiently prepared for welding. Being cut into lengths of about twelve inches, they are formed into a pile, an inch or an inch and a half high, laying the edges straight, so as not to overlap each other: a longer piece is then so fitted as to return over each end, and hold the whole together in the fire. This pile is then heated to a welding heat, and drawn out into a bar of about one inch wide, and one third of an inch thick; it is then doubled up in three or more lengths, and again welded and drawn out as before; and this operation is repeated generally to the third or fourth time, according to the degree of fineness of twist required. The bar is then to be heated about a third of its length at a time, and being struck on the edge, is flattened the contrary way to that of the stratification. This part of the operation, brings the *wire* or *vein* outwards upon the strap. The barrel is then forged in the usual way, but much more jumping* is used, than in the English method, in order to render the twist finer. The most careful workmen always make a practice of covering the part exposed to the fire with a lute, composed of mud, clay, and the dung of cows or horses, in order to guard against any unnecessary oxydation of the metal. When the barrel is completed, the twist is raised by laying the barrel, from one to five days, either in vinegar, or a solution of the sulphate of

* Or upsetting endways, by striking the barrel against the side of the anvil while it is of a welding heat.

iron, until the twist is raised; this process is called the *wire twist*.

To produce the *curl*, the bars or straps are drawn into bars about three quarters of an inch square, and twisted, some to the right and others to the left hand; one of each sort is then welded together, doubled up and drawn out, as before described; and according to the skill and experience of the workman, any intricacy of twist is produced, by thus drawing out, doubling and twisting.

Sometimes, to save trouble, and economise the iron thus prepared, the artist will rough file an English barrel, weld a strap of Damascus iron spirally round it, or several straps are laid longitudinally along it, and welded on. A native artist never works with pit coal, under any consideration: charcoal from light wood forms his only fuel.

### ON THE DAMASCUS SWORD BLADES.

In making the sword blades, there are several methods used; some workmen make a pile of alternate layers of softer and harder cast-steel, with powdered cast-iron mixed with borax, sprinkled between each layer.* These are drawn out to one-third more than the length of the intended blade, doubled up, heated, twisted and re forged several times; *the twist is brought out* in the same way as that in the gun-barrels, namely, by the use of vinegar, or a solution of sulphate of iron.

Some sword-blades are forged out of two *broad* plates of steel thus prepared, with a narrow plate of good iron welded between them, toward the back, and thus leaving *solid steel for the edge*, to a considerable depth.

Others prefer to make them of one plate of steel, with a lamina of iron on each side of it, to give them strength and toughness.

Swords of this description were tempered in my brother's presence, in the following compound; and, as he states, with considerable effect.

### THE HARDENING COMPOSITION.

The blade was covered with a paste, formed of equal parts of barilla, powdered egg-shells, borax, common salt, and crude soda, heated to a moderate red heat; and just as the red was changing to a black heat, quenched in spring-water.

From the information of the workman, it appears that Damascus obtains all its steel from the upper part of the Deccan, where it is called *fonlode hind*, or Indian steel, of which there are great quantities and but little or no demand for it. The *Damasaque* (or *joar*) is natural to this steel; and the veins in it are raised by immersing the blades in acid solutions.

* The soldering steel or iron with cast-iron and borax, and welding afterwards thus, seems to be an Eastern practice.

## REVIEW OF 'HINTS ON THE ECONOMY OF HEAT.'

Messrs. Editors—Your correspondent Philo in the last Magazine, has given some 'hints,' to which he appears to attach considerable importance; but, not judging from the same criterion which he has apparently adopted, I must acknowledge, that the great benefit resulting from such a plan as he proposes, is beyond my comprehension. I really cannot believe, that Philo wrote his communication with any idea of its practicability; if he did I can only say, that it is the *grandest* scheme, with the *least* advantage, which he could possibly have imagined; in the prosecution of his plan, he has sacrificed comfort, convenience, and usefulness without mercy. I would inquire, what degree of heat the air would possess after travelling through miles of tubes placed under ground? or in what manner is a house to be warmed, if the main conducting tube of that house should by any accident be injured?

Not to extend this critique to an unlimited length, I must pass over without comment, many of the numerous inconveniences which overwhelm the usefulness of the project. For, after all his trouble, and expense of pulling down chimneys and placing them under ground, and besides risking the danger of suffocation from the dry (I cannot say hot or warm) air, ejected into the rooms of his houses with the force of a steam engine, he is scarcely any more secure than with his fire places and stoves, as at present. The idea that candles or lamps would set fire to a building, entirely escaped the vigilent eye of Philo in the formation of his plan, or he certainly would never have neglected to provide a remedy against their effects, when in fact most of our destructive fires are occasioned by them. For my own part, I cannot think that building our 'chimneys' under ground, is the best method of securing the advantage suggested, because the fires which originate from stove-pipes are in consequence of utter carelessness, for who can suppose that a stove-pipe surrounded with dry laths or boards, will not endanger the building in which it is? But yet, absurd as this appears, the greater number of fires arising from stove-pipes may be attributed to this cause alone. Let *us* then, instead of giving advice to founders of cities or towns, recommend to our own citizens, a plan not only superior to Philo's in regard to its practicability and usefulness, but one absolutely necessary, for the security of their houses and property; this is, to allow nothing to come in contact with the stove-pipe that is inflamable, or will conduct the heat; brick or stone is much better than the plate of iron which is commonly used. If this is attended to, and the chimneys built properly, all the security of the plan of Philo will be accomplished without his inconveniences.

Another great object to be gained, according to the ideas which Philo has advanced, is the economy and usefulness of his plan, in the settling of towns and districts. This we will *not* condemn, without as fair an examination of its merits as the case will admit

To begin therefore, we will imagine ourselves ready to adopt the plan proposed by Philo, and commencing operations by endeavoring to find a place for the building in which the air is to be heated But here we are stopped—an unsurmountable difficulty arises, for Philo expressly declares, 'that this establishment must be located near some navigable canal, or good land conveyance,' which according to our experience in settling towns and districts, is the last thing to be found. In the same reasonable strain, he proceeds to the *economy* of his plan; this is the most incomprehensible part of the subject, especially as regards the adoption of such a plan by a city like Boston, for Philo forgets that more land would be required for building a complete house, with a kitchen in the rear; and consequently rents would be raised in proportion, and likewise how many hundreds of families are forced, from their circumstances, to occupy but one room, which is to answer for kitchen, parlor, chamber, &c., and even then with their scanty means, can scarcely obtain a living. How then, I would ask, is this class of persons to be situated? are they to be exposed to all the dangers of fire, and receive no beneficial effects from the economical plan proposed because of their poverty? or is it a fact, that it is intended for the use of the rich, or that class which least require it? If this is the principle of economy which Philo has discovered, he is certainly entitled to a *medal* from a Humane Society, or to have his name *perpetuated* by being engraved upon one of his *chimneys* under ground.

I cannot help pausing with astonishment, at the greatness of the mind, that can conceive of building a town with the same ease that the plan is drawn. For 'ourselves' we should be obliged to get initiated more deeply into the mysteries of fairy-land, and study with more attention the sublime truths contained in the Arabian Tales, before we could 'picture to ourselves,' a New England emigrant going to the west, and amidst the tractless woods and wild prairies, building (instead of a log hut) a commodious house, 'without chimneys'—'locating an establishment near some navigable canal, or good land conveyance, where air may be heated and forced through subterraneous tubes by a *steam engine!*'—or, building his house in one place, kitchen in another, and shop in another, and in the centre, 'a watch tower, with an index which can be swivelled to point out the direction of a fire!' The latter clause is really of more importance, than would be at first supposed; and to impress it on the minds of our readers, I would beg them to recollect the extensive space to be secured, if the above improved plan of building towns and cities, should be adopted, instead of the present *inconvenient* and *dangerous* method.

Although such a task is doubtless a *trifle* to the mind of Philo, who can calculate with *mathematical* accuracy, the centre from which a town would diverge during the existence of time; yet it is no easy matter, for the shallow brains which many of *us* possess to follow *him* through all the ideas which he considers connected with the subject. For this reason, I have no doubt if Philo would

publish the *formula* or *method* by which he can discover the exact spot upon which the 'watch tower' is to be built, that will always remain the centre of a city or town, and what kind of *apparatus* must be used by the watchman stationed in the tower, with which he could see the *inside* of a house when on fire in any quarter of a city, and give the alarm before the flames appeared upon the *outside*, or to distinguish the difference, between the flashing of a torch or lamp at a distance, from a *fire*, he would not only gratify my curiosity, but confer a lasting favor upon the students of *mathematics* and *philosophy* throughout the world. J. M. W.

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From the Journal of the Franklin Institute.

## METHOD OF TINNING CAST IRON, &c.

Gentlemen,—Having frequently tried the following process for *tinning cast iron*, and having found it very easy of execution, and certain in its operation, I am induced to offer it for the benefit of those of your readers who may have occasion to use some process to effect the same purpose. This method is applicable to all sizes of castings.

The surface of the casting is first to be made perfectly clean, by turning or scraping away the outside. Filing does not answer so well as turning or scraping.

Make an amalgam of tin with mercury, containing enough tin to form a soft solid, say of the consistence of butter at 60°.

Prepare a dilute solution of muriatic acid; the muriatic acid of the shops diluted with about an equal weight of water, will give an acid of convenient strength.

Heat the casting until so warm that on a further addition of heat it could not be held conveniently in the hand. Dip a clean linen rag into the dilute acid, and wash with it the surface of the casting where it is to be tinned. Upon another piece of clean linen take up some of the amalgam, and pass it over the surface which has been wet by the acid.

A portion of the amalgam adheres; by rubbing, the tin is precipitated upon the surface of the iron to which it is united, and the face is tinned; after which the article should be immersed in a bath of melted tin and rosin to perfect the coating.

The explanation I take to be this. The diluted acid, aided by heat, acts upon the casting, forming a chloride of iron; when the amalgam is presented to this, the chloride leaves the iron to combine with the mercury, and the iron and tin are precipitated in very intimate union if not in chemical combination. I do not mean to lay particular stress upon this explanation, the steps of the process are detailed just as I have frequently taken them.

It may not be amiss while writing to give an illustration of a method of making available for purposes of art the polish which nature presents in some melted solids. The polish of a clean sur-

face of an alloy of melted tin and lead is very beautiful. Suppose it be desired to fix this upon a tube of copper or iron, as upon the iron spouts attached to tea kettles of tin. The tube is, if of copper, to be prepared in the usual way, and, if of iron, to be well tinned by the method just given, (or any equivalent one.)

Dip the tube into a vessel of a melted alloy, of tin and lead, and allow it to remain until thoroughly heated. On withdrawing the tube the liquid metal runs down the surface. Pour rapidly *into* the tube cold water. The metal will immediately fix upon the outer surface, retaining the polish which it had when liquid.

ISAIAH LUKENS.

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From Gill's Technical Repository.

## HOW TO TIN NAILS AND TACKS, &c.

First clean the surface of the articles to be tinned from rust or other oxide, by pickling them, or putting them into sulphuric, muriatic, or nitric acid, diluted with water, as usual, and washing them well afterwards in water; then put them into a stone ware gallon bottle, together with a proportionate quantity of bar and grain tin, and of sal-ammoniac: next place this vessel, lying upon its side, over a charcoal fire, made upon a forge-hearth, and keep turning it round, and frequently shaking it, to distribute the tin uniformly over the surfaces of the articles to be tinned; lastly throw the articles into water, to wash away all remains of the sal-ammoniac, and finally dry them in saw-dust made warm. The great merit of the process consists in the employment of the stone-ware vessel, which not only prevents the dissipation of the sal-ammoniac in fumes, but also gives up the whole of the tin to the articles to be tinned, which would not be the case were a metallic vessel to be used.

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From a Manchester Paper.

## STEAM-BOILER EXPLOSION.

ON Thursday, the 22nd of March, the extensive calender house of Messrs. Goodier & Co. of Manchester, was almost entirely demolished by the explosion of a steam-boiler; five persons killed, and many others severely wounded. On the forenoon of that day, the engineer discovered that the eccentric motion which worked the steam-valves had sustained some injury; a millwright was set to repair it; but as it was expected the repair would be completed in the course of the afternoon, moderate fires were kept under the boilers, and the steam kept up. The works were driven principally by an engine of 32-horse power, not a high pressure one, but a condensing engine of the best kind, made by Boulton & Watt; and it was worked at a pressure never exceeding 12 lbs. on the square inch. It was supplied with steam from two twenty horse boilers, which were placed side by side transversely across the cellar of

the building. The safety valve is stated to have been five inches in diameter, and to have been loaded with 224 lbs. being about ten pounds to the square inch. But it seems there were no safety valves on the boilers themselves, but one upon a large pipe which conveyed the steam to the cylinder. Between that pipe and the boiler were stop cocks, so that each boiler could at pleasure be shut off from the pipe. It is supposed that one or both of the boilers had been thus shut off, for the conveniences of making the repairs. If so, the steam could not act upon the safety valve, and the pressure becoming too great, an explosion was the necessary consequence. In 1828, an explosion took place from this very cause at the factory of Mr. Thomas Kearsley, at Tryldesley, by which ten persons were killed, and great part of a new and extensive building demolished.

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## ANSWER.

In answer to Joseph in our last number, we would say, that the small wheel would revolve 127 times, and the large one 21 times, before the same two cogs would meet again.

The following rules are taken from Evan's Millwright's Guide, and may be of service to our readers. EDS.

1. Divide the cogs in the greater wheel by the cogs in the lesser; and if there be no remainder, the same cogs will meet once every revolution of the great wheel.
2. If there be a remainder, divide the cogs in the lesser wheel by the said remainder; and if it divide them equally, the quotient shows how often the great wheel will revolve before the same cogs meet.
3. But if it will not divide equally, then the great wheel will revolve as often as there are cogs in the small wheel, and the small wheel as often as there are cogs in the large wheel, before the same cogs meet: oftener they can never be made to change.

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## QUESTION.

Meeting with the following question not long since, my curiosity was excited by its singularity and though I have tried to solve it several times I have not been able to get the precise answer. The answer I obtained gives one mill and a fraction too much. Some other persons have also been unable to solve it; among them are two teachers of schools. If any of your correspondents will give the precise amount of each man's share they will oblige A SUBSCRIBER.

Three men were employed to draw a load of plaster from Boston to Windsor for $26 45, each man having one horse. A and B's horses are supposed to do 3-4 of the work, A and C's 9-10 and B and C's 13-20. They are to be paid proportionally. What is each man's share of the money? B.

THE

# YOUNG MECHANIC.

VOL. I. NOVEMBER, 1832. No. XI.

## OBSERVATIONS ON DRAWING INSTRUMENTS.

[Continued from p. 148.]

### SMALL AUXILIARY INSTRUMENTS.

Fig. 1.

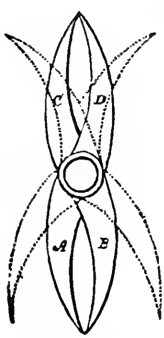


Fig 2.

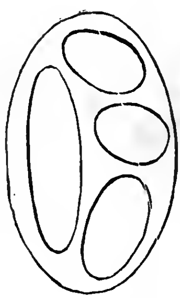

Fig. 3.

Fig. 4.


Fig. 5.

Fig. 6.

THE *Calipars*, Fig. 1, is an instrument very similar in construction to a pair of whole and half compasses, and is used for taking the internal and external diameters of cylinders, cones, &c. It cannot properly be called a drawing instrument, but forms a very useful appendage to a case. The two legs A B are of the same length with C D, and when the instrument is opened the latter cross each other as shown by the dotted lines, and when it becomes necessary to take the internal diameter of a hollow cylinder the legs C D are placed inside and opened till their extremities touch the interior surface. The distance measured between the points A B is the distance sought. The ***Pistolet***, Fig. 2, is used for drawing irregularly curved lines, and may be made of wood or metal. From the difference in the curvature of different parts of it, it can

generally be adapted so as to draw almost any line, in a much nearer manner and with much more exactness than can be done by the hand alone. Small strips of whalebone, some of them of an equal thickness throughout, serve to draw curves, the curvature of which only varies a small quantity; others, gradually thinned towards one or both ends, serve to draw parts of a curve, or any curve diminishing gradually like them from one extremity to the other. The slips of whalebone are bent so that they pass through the points indicated on the paper as belonging to the curve to be made, which is drawn by a pencil resting against the curved whalebone. Small triangular pieces of lead covered with paper or cloth that they may be used with the greater ease supply on the paper the place of pins, for confirming the slip of whalebone.

Fig. 3 is the *Port crayon*, and is used for holding a pencil when it becomes too short to be held conveniently by the hand. It is usually made of brass or steel, having two sliding rings for closing the extremities which are slit to adapt them to the different sizes of pencils.

Fig. 4 is called the *Eracer*, and is precisely similar in construction to an engraver's scraper, consisting of a triangular blade *a* (the sides of which are a little concave and gradually tapering to a point) inserted in a handle *b*. This instrument is decidedly the best for scratching out blots and lines, as it leaves the paper very smooth and even, so much so that it requires an experienced eye to discover the spot on which it has been used. It is not to be found in any of the imported cases of instruments, but may be purchased at any store where engravers' tools are sold.

Fig. 5 is the screw driver and key in one instrument.

Fig. 6 is made by inserting a small piece of India rubber, in the end of a goose quill, and is much better for taking out short lines, which are surrounded by many others, than the large piece of gum elastic which is generally used. A small one or two feet folding *pocket rule* should be attached to every collection of drawing instruments, one side being divided into inches and tenths or twelfths, and the other into inches and eighths, or tenths and hundredths of a foot. A rule of this description will be found exceedingly useful at all times, for taking measurements of models and all objects of which drawings are to be made. In the selection of this instrument the student should be very careful to have it agree with his other scales of length particularly in its subdivisions, or he will be continually liable to errors. It may be made of well seasoned ivory, and if packed in a small case it would not probably be affected by the heat of the pocket, by which rules are oftentimes cracked and destroyed.

(To be coucluded in our next.)

## MEMOIR OF A MECHANIC.

[Concluded from page 153.]

In June, 1823, I left Russia for the United States; and after a voyage of 63 days, was safely landed on India wharf in Boston, Mass.

I amused myself during the passage, at such times as my health would permit, in the study of Mathematics. I had previously made myself acquainted with the improved Engineer's sliding rule and decimal fractions, and committed to memory several useful factors; such as 3·1416, 7·854, 27·648, &c. These and many others were often used, to find the superficial and solid contents, and also, the weight of different bodies. After getting used to the motion of the ship, I commenced making a table, by which I might easily calculate the pressure of a column of water, of any diameter, and of any height. It began with a quarter of a foot, and was continued to several hundred feet high. Before it was finished, however, I perceived several repititions; for the very same figures occurred in different answers; and on examining a little further, I found out the rule by which they were governed, namely, shifting the decimal point; which enabled me to simplify my work very much. I found that the answers to the first nine numbers, would answer for all the others, whether above or below unity; and there is no limit to this, but our powers and our wants; for if we start with a millionth part of a unit, and continue to many millions of units, skipping only a millionth part at a time, we are still very far within its limits; and yet this can be done within a small space, for the table that I first prepared took up many times the room of the improved one, although it was much more limited. I was highly delighted with this discovery. It happened when I had several weeks of leisure, and but little to engage my attention. I pursued this subject with ardor, and before I left the ship, several tables for various purposes were prepared. The voyage seemed too short for me; but my wife was continually complaining of its length, so that my mind was very nicely balanced between two forces.

How tedious a sea voyage of several weeks must be, to persons who have no resources of amusement within themselves; whereas, persons of studious habits may, with a few books, pens and paper, beguile those hours which to others would be almost insufferable. The same may be said of persons confined in a prison, or by sickness.

Having got on shore, and my baggage safely deposited, I purchased a few books and maps for my immediate use, and set out on an excursion into the country, in company with a friend. We crossed the bay to Cohasset, and after climbing the slippery rocks we passed through some woodland to the village. My friend amused himself with his gun for three or four days, while I was looking about me; for everything seemed rather strange and

interesting. In the mechanical way, I saw several simple contrivances which answered the purposes for which they were intended. Among them were cheese and cider presses, and small wind mills with pumps, for raising sea water for making salt. Nature presented many interesting objects, some of which were new to me. The mighty ocean with its rocky shores, and the sea breeze on a sultry day; the wild woods with the chirping, and croaking of their inhabitants; Indian corn; the black snake, skunk and squirrel, and several kinds of birds and water fowl; were among the objects that attracted my attention. We went also to Marshfield; but the scenery here was less interesting. The stone walls which are to be met with every where struck me as very curious. The old lady of the farm house where we stopped was very communicative. She politely showed me the orchard, which was extensive, and the trees well laden with choice fruit. She was pleased with my account of other countries, and in return I was instructed in the mysteries of making fire cakes, dough nuts, &c. and also in peeling apples by machinery. The apple was stuck upon a fork, and caused to revolve by a crank, while a knife something like a spoke shave was held on the apple. The process is very simple, and expeditious. The apples were next quartered, and dried for future use. I was informed by her, that she stood at her front door, and saw the engagement between the Shannon and Chesapeake.

After returning to Boston, I began to think about employment. A small farm and mechanic's shop united, was what I had thought of; and with this view I went about forty miles, to look at a shop and some land that was for sale; but after examining two or three lots that were offered, I concluded it would be best to wait a few years, and get more acquainted with the manner of trading, which I found required some experience. I was led to this conclusion from a transaction that I saw. The man who had two lots of land to sell, called on a tanner and looked out a calf-skin, and after a long talk agreed to pay so much Indian corn for it. He told me it would make two pair of boots, and that the boot maker was to have one half the skin, to pay for working up the other half.

Soon after this, I was engaged to work in a machine shop, at a cotton factory located something less than thirty miles from Boston, where I remained three years, commencing in the middle of September, 1823. Six months passed away without being able to do anything towards my favorite object. In the spring of 1824, however, an opportunity offered for me to attempt the formation of a society for mutual improvement. Two discourses were delivered on fast day, by the clergyman of the village. That in the afternoon was on the importance of knowledge, and the facility with which it can be obtained, by a judicious arrangement of our time, and associating together for mutual benefit. In fact, he expressed my views on the subject so well, that I felt confident of a kind reception, and accordingly waited on him the same afternoon. After stating my views, and presenting him some papers on the subject,

he informed me that a small society for reading, had existed about five years in the village, but was at a very low ebb at that time. He was pleased with my proposals, and invited me to attend the next meeting of the society. I attended, and found a goodly number of both sexes assembled at the house of one of the members. They were engaged in reading by turns, from Whelply's compend of general history, and the president put questions to them as they proceeded, which made it interesting. At the close of this exercise, he asked me how I liked it. 'Very well,' was the reply. I then inquired what other exercise they had. He told me that was all, excepting an annual Address, which he delivered himself. I asked him if it would not be well to try the debating of questions, and familiar lectures on science and the arts. He said he thought well of it, but they felt very cautious how they ventured from the shore, lest they should get into deep water. I told him I thought they need not be afraid, for I had seen persons engaged in such exercises, whose opportunities for intellectual culture were inferior to theirs. I was asked if I could give them a lecture. I said I would try, and prepared myself accordingly. I had brought a small air pump from Russia with me, which I made of a piece of gas tubing, with a ground brass plate on the end of the barrel. I bought a few glass articles at a store, which were ground to fit the pump plate, with a little sand and water, on the hearth stone of my room. I also procured a small wash tub, and fitted a shelf to it for a pneumatic cistern. In this way I succeeded with a very simple apparatus, in explaining the mechanical and some of the chemical properties of the air. This put new life into the society. Their constitution was revised to provide for a library and apparatus. Debating was also adopted with success, and the ladies handed in compositions, which were read at the meetings. The reading exercise was pursued only occasionally. Several of the members were prevailed on to give lectures, on subjects connected with their professions, unless some particular branch of knowledge had been studied by them. It required considerable effort on the part of the active members, to bring those forward that were very diffident. More than one case occurred, however, in which gratitude was felt by those who had been thus roused into action.

The society continued to meet at the members' houses, until it became too large to be thus accommodated. They then tried the school house, and the hall at the tavern; but not being satisfied with these, they built a two story building for their accomodation, at an expense of twelve hundred dollars. The building was completed within two years from the time I was first introduced to the society. The hall was let to another society, and there were two mechanics' shops under the hall.

I left this place to reside in Boston in October, 1826, and have not visited it since, but have frequently heard of the prosperity of the society, and have seen two persons very recently, who report it to be in a flourishing state.

On my arrival in Boston, the very first business I attended to, was to make inquiries respecting mechanics' societies, and was surprised to find that no society existed, to which a mechanic could go and hear lectures on subjects calculated to aid him in his vocation. There had been some talk of building a mechanics' hall, &c.; but that project was abandoned. I conversed with several persons on the subject, who were willing to assist in forming a society for mutual improvement. I put a notice in a newspaper, stating where names would be received, and finally called a meeting, which was attended by nine persons, and a second meeting which was attended by only seven. At this meeting it was determined to make the thing more popular, by advertising in the daily papers, and hiring a hall in a central situation. The next meeting was held at Concert Hall, and was very well attended. The result was the formation of the Boston Mechanics Institution.*

This society soon became very popular, which induced others to imitate the example thus set; by which it was evident that in Boston, as well as in other places, it only required a little exertion on the part of those who felt an interest in the subject, to induce a portion at least of our citizens to improve these advantages.

The Massachusetts Charitable Mechanic Association was next in the field. Soon after this, meetings were held to form a lyceum adapted to the city. Several plans were offered, but none of them met with general approbation. The consequence was, a division took place. One party formed the society for the Diffusion of Useful Knowledge, while the other formed the Boston Lyceum. Since that time, several minor soiceties have been formed,† besides the Franklin Lectures which have been got up particularly for the accomodation of Mechanics.

Boston is now well supplied with societies for the improvement of the mind. Some of the larger ones, however, should be modified. The four societies which I have named above, have each of them regular courses of lectures; but they treat on so many different subjects in one season, that no person can get more than a smattering knowledge of any subject. Each society should take its own stand. Let one take a stand decidedly of a mechanical nature, another of a mercantile, &c ; and instead of one or two lectures on a subject, let there be a dozen given, if the nature of the subject requires it. We should then get information that would be more substantial; our knowledge would be more thorough; and the interests of the various societies would not clash.

I have now accomplished my task; and in conclusion I would observe, that I have had considerable pleasure in reviewing my conduct, in my leisure hours, as many of my notions have since been of substantial benefit to me in my trade. My aim has been,

* Some account of this society will be found in our last number, page 163. EDS.

† A list of these societies is given at page 97 of our June number. EDS.

to blend amusement with instruction. If this has been done, I am satisfied. To my young friends I would say, that knowledge is power, wealth, and distinction; that industry and prudence will in general, lead to independence and respect; while idleness and dissipation, will end in slavery and disgrace.

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## IMPROVEMENT IN PLASTERERS' TOOLS.

Messrs. Editors—Among the innumerable multitude of labor saving machines, there is none for rendering more easy that extremely laborious employment, plastering. The present method requires the whole strength of a man to be exerted, through nearly the whole process; consequently producing excessive fatigue, and unfitting him both bodily and spiritually for intellectual pursuits or rational amusements. Permit me then, to assure those persons who possess the nack of invention, that if their ingenuity can construct a machine for leveling plastering, which will dispense with the present heart-aeking and bone-acking method, they will receive ample pecuniary compensation and the sincere thanks of a large class of practical mechanics. D. B. H.

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## ETCHING ON GLASS.

Messrs. Editors—The following is a simple method of etching on glass on a small scale. First spread a thin coating of beeswax over the vessel you wish to etch, then with a fine pointed instrument mark through the wax down to the glass. Put in a tin or leaden cup about a table spoon-full of pulverised fluor spar, and upon this pour a sufficient quantity of sulphuric acid to moisten it. Place the glass on the cup with that part which is to be etched downward. Then put the cup in warm water for about 20 minutes, when the etching is finished. Care must be taken not to melt the wax.

L****e.

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## A LARGE TREE.

The following account of a remarkably large tree I copy from the London Mechanic's Magazine. A. Z.

'An oak tree was a short time ago felled in Ludlow, near Shopshire, the produce of which was thirty nine tons of timber, fifty five cords of wood, two hundred park pales, and four cords of brackets, A bough broke off before the tree was cut down which weighed seven tons and a half. Three men were employed a month in stacking it. The tree was valued at £165.'

From the Journal of the Franklin Institute.

# APPARATUS FOR RAISING HEAVY WEIGHTS.

Dear Sir—I send you the description of a hook or lever for raising stone, which I have found very useful for the particular purpose for which it was intended. It is, I believe, new; but it is very possible that your intimate knowledge of whatever has been done in the way of mechanical contrivances, may convict it of being a 'modern antique.' If you cannot find its prototype, I think I may safely lay claim to it as an original invention; and in that case I would thank you to insert this description in your valuable journal, with a hope that it may be found of use in other cases similar to that in which I have employed it.

Yours, respectfully,

Baltimore, July 31st, 1832. Wm. HOMARD.

DESCRIPTION.

The M'Kim school, now erecting in Baltimore by the liberality and taste of a public spirited individual, is to be an exact copy, as to the portico, of the celebrated temple of Thescus at Athens, and of the precise size of the original. The body of the building is composed of blocks of granite ashler, from Ellicott's mills, each course being of the same height. To permit these blocks to be placed with accuracy and convenience, it was necessary to suspend each one in such a manner as to leave its bed and sides entirely free. The Lewis with two pins, represented in fig. 1, and similar to one described in Rondelet, *Art de Batir* was tried, and found to succeed very well, requiring only two holes to be bored about three inches deep, which can be done in the granite with great facility. Still it was desirable to avoid the labor of fitting this Lewis to more than 400 blocks, and the contrivance represented by fig. 2, was invented for the purpose, and has been found to answer perfectly.

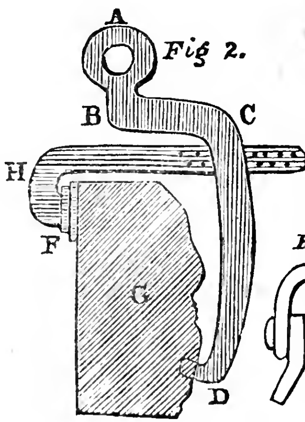

Fig 2.

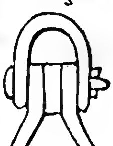
Fig 1.

It consists of an iron bar, bent in the form A B C D, and of a size proportionate to the blocks of ashler intended to be raised. At C a mortise is made through it, admitting freely the bar H E. This bar is pierced with holes, as shown in the figure, through one of which an iron pin is put, to prevent it from slipping towards H. At F is a plate attached to this bar, between which and the ashler block G, a piece of wood is placed to keep the iron from injuring the worked face of the block. The end D forms a steel pin, which may be inserted about an inch into a hole bored in the block; but in cases where the least projection or shoulder can be found for this point to catch hold of, this labor of boring is not necessary; the smallest prominence being sufficient to give the instrument a perfectly firm hold, or gripe, of the stone, which becomes still firmer as the weight comes to bear on it.

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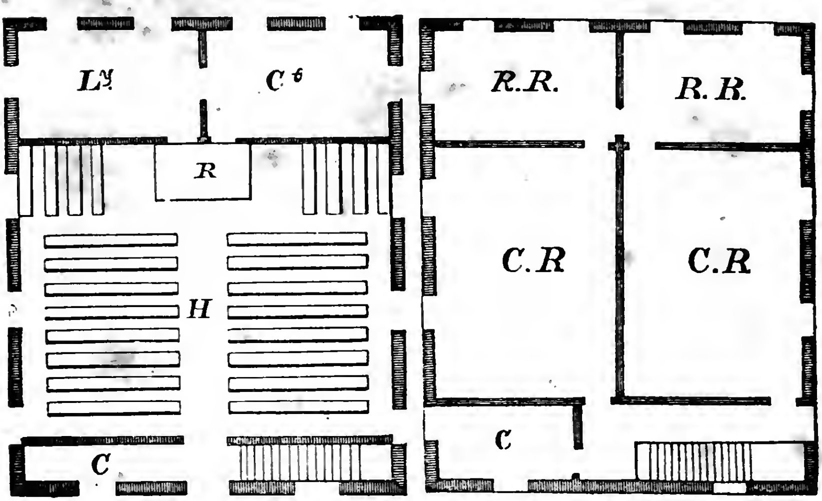
From the Family Lyceum.

## VILLAGE LYCEUM.

*First Floor.* *Second Floor.*




Every year and almost every day is placing these social and republican institutions upon a more permanent foundation. Experience is constantly bringing up new measures to increase their interest and extend their usefulness. And no two steps are probably more important, than the erection of commodious buildings and a system of circuit teaching, each eminently calculated to aid the other, and both united capable of ensuring complete success in

any town or village in the United States, where the two measures shall be adopted.

A Lyceum building, furnished with apparatus, collections in natural and artificial productions, books, &c., could not fail to give interest to the instructions of a circuit teacher, who should use them in 6 or 12 towns in succession: and the aid of an experienced teacher, even if it was but once a fortnight, must render the personal and mutual efforts of his pupils in the use of their *intellectual tools* doubly efficient and interesting.

Above will be seen the plan of a Village Lyceum, representing the rooms in the first and second stories. On the lower floor, is the hall, or public lecture room, the labratory, and the cabinet: on the second floor, are two class-rooms, two recitation-rooms, and a closet for depositing such apparatus, books, &c., as may be needed from time to time in the upper rooms.

Suppose that a circuit teacher was to spend half a day in giving instruction to a Lyceum, and especially in aiding the members to instruct each other. The first exercise might be a lecture on Astronomy, Geology, Geography Geometry, Grammar, Arithmetic or any other useful subject, to both sexes, and all classes and ages, who might be disposed to hear it. After this general lecture, the Lyceum might be dispersed into the several rooms, according to their classes, and pursue such subjects as they might severally think most expedient. Thus, Writing, Composition, Geometry, and Arithmetic, might be going on at the same time in the different rooms, the teacher having a general oversight of the whole.

Suppose that fifty-two half days in a year for ten years be spent in that way by a young lady or gentleman, commencing at ten years of age; and who can doubt but that in nine times out of ten they would procure a far better education, than they could in three years at an academy, at one quarter of the expense?

If the citizens of any town or village should doubt their ability to procure these accommodations for social and practical knowledge, they are requested to turn to the third number of the Family Lyceum, or otherwise to examine the *economy* of such institutions, and they will find, that money thus invested will pay two hundred per cent. in gold and silver, to say nothing about the profit, the pleasure, and the dignity of well cultivated minds and hearts.

A moment's examination must convince any one, that there is not a town or village in the United states, where a commodious Lyceum building would not be good property. In our older settlements, they are important and easily procured; in newly settled countries, they are nearly indispensable, as some places for education and religious worship are necessary, and as it is difficult at the outset to procure all the public buildings which might be desirable.

A Lyceum would not only furnish accomodations for a system of circuit teaching, to be given once in one or two weeks, but it

might be used for a daily school, and for religious worship on the sabbath; and through most of the western states, furnish better accommodations than are at present provided.

It may be asked how these Lyceums can be erected? To this question the answer is short. Let fifty persons each take a share of twenty-five dollars; or a smaller number take fifty shares of twenty-five dollars each, and it would raise $1,250, which, in a large majority of cases, would be sufficient. In the most newly-settled places, where it might be difficult to raise even that sum in money, the labor, timber and other stock, contributed by the citizens, might answer as a substitute. In one way or other, such a building may be procured without inconvenience in each of the five thousand towns in the northern states, and one at least in every county in all the states at the west and south. And however it may be procured, the history of every community since the first city was built by Enoch and called by his own name, proves that it would be for the pecuniary, no less than the intellectual and moral prosperity of those who might provide it for themselves and their posterity.

What portion of a community need fail of receiving instruction and entertainment from such a place of social and intellectual resort? Could not the farmer resort to it for special instruction in agriculture from his fellow-laborers, as well as for a knowledge of general science by professional teachers? Might not mechanics also hold there, special meetings? And might not each Lyceum be a Teacher's Seminary, where those living in the vicinity might meet, and aid each other in their responsible and dignified profession? Might not ladies resort thither once a week during the summer, and receive the water of life from the same fountain? And *Mothers*, too; where could they go, to receive so much benefit from *each other*, in their dignified charge, their holy office, as at the Village Lyceum, where every thing might be found calculated to enlarge and gratify those deathless spirits to which they gave existence, as they were fast budding for immortality? What man, what woman, what child, might not be made wiser, and happier, by such a fountain of knowledge? Of what town, village or neighborhood will the citizens withhold their hands from a work, which will ensure to themselves and their posterity the blessings of wealth, and the dignity and happiness of enlightened minds, and pure and elevated hearts?

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## PATENTS FOR MASSACHUSETTS,

GRANTED IN APRIL, 1832.

For an improvement in the *Machine used for Pegging Boots and Shoes.* Frederick Gray, Rowley, Massachusetts, April 6.

The machine here patented for pegging boots, consists of an improved apparatus for holding the last firmly during the operation;

to explain the contrivance clearly, would require a drawing, and we think but few will feel interest enough in the subject to regret the want of this appendage.

For a *Machine for making Axes.* Josiah Pratt, jr., Claremont, Massachusetts, April 6.

This machinery consists of what the patentee denominates hammer and anvil dies; the first kind are to be worked like a trip hammer, the last, as the name indicates, forming the anvil, or bed. A particular description of the curvature of the faces of these dies, and of their size, is given in the specification.

The foundation of the axe from the bar of iron, is laid with one pair of dies, and another set is used for finishing. There is no claim made; reliance being placed on the entire novelty of the whole plan. 'The manner of holding the iron under the dies, and the skill of moulding the axe,' we are told, can be learnt only by observation and practice.'

For machinery for *Cutting and Manufacturing wooden boxes.* Harrison Holland, Belchertown, Massachusetts, April 13.

Wooden boxes are of so many kinds that the above title must fail in furnishing any definite idea of the intention of the machinery; nor does the petition, or the specification, supply the required information; we collect, however, from the drawing and the general description of the apparatus, that the boxes are to be round, and made out of solid stuff. An auger, running in the mandril of a lathe, is used to bore the boxes out, whilst cutters, placed at a proper distance from the auger, form the outside. A sliding carriage in front holds the timber, and this is brought up by proper contrivances against the auger and cutters. A circular saw, upon a sliding carriage, is used to cut the box off. The lids, it is said, may be formed on the same principle, but in this case the auger is to be shortened in due proportion. At the end of the specification we are told that 'green timber will answer as well as that which is seasoned. This information is not calculated to throw much light upon the purposes for which the said boxes are to be made, as they will soon lose their rotundity if made of unseasoned stuff.

There is no claim made to the machinery as a whole, or in part, excepting that in speaking of the auger with which the boring is to be effected, it is said that it is a 'screw auger, *without a centre;* this is claimed as a new invention, and may be applied to other uses.' The fact is, that the screw auger, without a centre, has been applied to other uses long since, and therefore it is not new. We have in our possession one of this description, which was patented so long since that the patent has run out.

For *Door Fasteners.* Calvin Washburn, Bridgewater, Massachusetts, April 18.

This is a spring door catch, operated on by handles in the usual way, but with some peculiarity in the arrangement of the parts which may be called new, and upon which the claim rests. We

are not aware, however, that it is superior to some others, and shall therefore dismiss it, as, without a drawing, its peculiarity could not be easily described.

For *Protecting Bank Notes, &c.* from being counterfeited Francis Peabody, and Joseph Dixon, Salem, Massachusetts, April 20.

The object had in view by the patentees is to prevent the counterfeiting of bank notes by means of lithography. Those acquainted with that art are aware that the impression upon a bank note, or other engraving, printed with ink into which oil enters as a component part, may be transferred on to stone, and the stone then used to furnish similar impressions on paper. According to recent accounts from Europe the utmost perfection has been attained in this process, which, as it is merely mechanical, may enable one who is no artist to imitate the work of the best engravers in a way which shall defy detection.

The means by which the patentees effect their object is by taking printer's ink, or ink made from oil, which is to be made of a pink, light blue, or other tint, and which will serve as a ground for the black ink generally used in printing bank notes. The paper intended to be printed on is first covered wholly, or in part, with the light colored oleagenous ink, and after this the notes are printed with black ink in the usual way. Any attempt to make a lithographic transfer from paper so prepared must fail altogether, as every part which has either the tinted or the black ink on it, will affect the stone, and only a confused, blurred impression, can be obtained from it.

The claim is to the preparing of paper in the manner described.

For an *Engine for turning Whip Sticks*, or Handles. Andrew Mallory, Russel, Massachusetts, April 27.

This engine is intended to be used in turning whip handles tapering, either regularly or otherwise, and it may also be employed for helves, or other sticks, whether cylindrical or tapering. The stick to be turned may be fixed in the mandril of a common turning lathe, and the apparatus here patented placed in front of it. It consists, in part of a frame with parallel sides, equal in length to the length of the stick to be turned. A piece carrying a cutter, which operates as a gouge and chisel, slides along in grooves on these sides. This sliding part consists of two bars hinged together at one end, and capable of being opened or closed at the other; and near to this latter end is fixed the cutter before spoken of. The stick to be turned rests on a hollow bearing of metal on the lower piece, and the cutter passes through the upper piece. It is evident that if these two parts, which formed the hinged sliding bar recede from each other as the bar advances, the article operated upon by the cutter will have a corresponding increase in its diameter. To effect this, each of the bars has a tongue on it which slides in a groove on one of the cheeks of the frame. There are, of course two grooves, and if these were parallel to each other, the two parts

of the sliding bar would keep at the same distance apart, and the article turned would be cylindrical; but if the grooves recede, the bars will be gradually separated, and the article will be tapered.

The whole machine is claimed as new, and not as an improvement on any other for the same purpose previously known.

For *Applying Copal or other Varnish* to Whip stocks, or other articles, by dipping. Frederick Morgan, Westfield, Massachusetts, April 27.

The articles to be operated on are to be dipped into a tube filled with the varnish, which, it is said, is a superior method to the use of a brush. This is the whole recipe, and we are very apprehensive that there are but few persons in the habit of using varnish who have not occasionally resorted to the same mode; we have repeatedly done it, although not with whip stocks, and we may probably do it again, with 'other articles,' the patent before us to the contrary notwithstanding.

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## ECONOMY OF HEAT.

Messrs. Editors—Your hopeful correspondent J. M. W. has undertaken the task of reviewing my 'hints on the economy of heat,' &c. He has performed it in a style which indicate that his ship carries more sail than ballast, or at any rate, that on this occasion he has condescended to use a pound of ridicule to an ounce of argument, and has shown his weakness by attacking those parts the most furiously that were of the least consequence, and still more so, by altering my language to suit his own purpose. I shall pursue a different course, and confine my remarks to points of most importance. As to the state of the air, the queries are—the quantity of heat it will contain after travelling through miles of tubes—whether it will be hot or warm—and the danger of suffocation from dry air. These might be startling questions if put to one entirely ignorant of chemistry, but thanks for my good fortune in having picked up a few facts that will be of service to me at this time. That air has been heated in one room and conveyed in tubes to other rooms at short distances, will not be denied; but how far it might be conveyed without too much waste of heat, must be determined by experiment. In England an attempt was made to cool the air in the heat of summer, by passing it through a subterranean passage to a meeting house, but was found not to answer because the sides of the passage gradually acquired nearly the same degree of heat as the external air, and finally had very little effect on lowering its temperature. This is favorable to my plan; for if the tubes were lined with some substance that were a very slow conductor of heat, and the air passed through them with considerable velocity, it might be conveyed to a great distance

with but little loss of heat. With respect to the danger of suffocation from the air being too dry, I believe it is an established fact, that the hotter the air is, the greater quantity of aqueous vapor it will hold in suspension; and if the air be allowed to pass over a sufficient surface of water, it will take up just what vapor it needs, and deposit it on the sides of the tubes as it parts with its heat; so that by proper management the air may be kept in the most fit state for breathing. If it were necessary, jets of steam might be suffered to play into the hot air as it left the furnace. It is asked, What is to be done if the pipes should be injured by accident? I should say, for want of a better remedy, that stoves may be used *pro tempore* until the pipes are repaired; and if there are no chimneys in the house, put the funnel through the window, as is often done at present. But I apprehend there would be other plans thought of if the thing were carried into operation, as there has been when the pipes used for water, or gas, got out of order. Our reviewer speaks of ejecting the air into the rooms by the force of a steam-engine, as though we were to be blown out at the window by the tremendous blast. I would observe, that although the steam-engine is very powerful, it can be used for the most delicate work; and in this case methods for regulating its power, so that the air can be admitted as gently as we please, will be readily found. As the air would be constantly issuing from the room to give place to fresh air, there would be none of those draughts of cold air so injurious in our present modes of heating by stoves, supplied with air from the various crevices in the sides of the room.

The kitchen at the back of the dwelling house seems to trouble J. M. W. considerably. I will point him to a quarter of this city where no kitchens are used. What objections are there to warming by hot air the buildings on the wharves, and on the various streets where there are no dwelling houses, and moreover where there are seldom any lights wanted at night. If there are, the gas lights do not produce sparks; and if it is necessary to carry a light about at all, it might be put into a lanthorn. Having noticed what I supposed to be most important, I shall leave the rest for another opportunity if it should appear necessary. PHILO.

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## A GOOD EXAMPLE.

We extract the following from a letter recently received. If this example were followed generally, the Young Mechanic might be enlarged and otherwise improved, so as to increase its usefulness without altering the price. We have received several such testimonies of approbation, and can only say to all our friends, go and do likewise.

EDS.

Messrs. Editors—I enclose $12 for twelve subscribers to the Young Mechanic. Please to remit all the numbers published, and send the remaining numbers when published by mail. I perceive that persons

obtaining subscribers are entitled to every sixth copy. However, I do not require it, as I have obtained the subscribers partly in my leisure time, and I further consider it a duty incumbent upon every man that wishes to promote the arts and sciences, to bestow a small portion of his time in trying to circulate general mechanical knowledge; for every intelligent man must know, that a nation can never be blessed or prosperous, unless she enjoys a high cultivated state of mechanical science; and I think, that a work like the Young Mechanic is well fitted to disseminate this branch of knowledge. Consequently, I shall recommend it to my friends and others without any compensation.

Lowell, Oct. 31. 1832. W. W. C.

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## ANSWERS.

We have received several answers to the question in our last number, from which two are selected. They are of two kinds. One says the question as proposed is impossible to answer. The other admits of the denominator being altered to correspond with the numerators. We are inclined to the first opinion, because it will not work both ways; that is, if A and B's horses do 3-4 of the work, of course there is only 1-4 left for the horse C to do. By reasoning in this way we find that A does 7, B 2, and C 5 twentieths; and if we make the denominator 14, the answer differs from that obtained by making the denominator 23.—EDS.

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A \$9·25 3-4. B \$10·58. C \$6·61 1-4.

A and B's horses did 3-4 of the work, C's horse 1-4. A's and C's horse did 1-4 or 5-20 and C's horses 13-20, B's horse must have done 8-20, and A's horse must have performed the remaining 7-20. A and C's horse did 6-10, and not 9-10 of the work as stated in the question. R. S.

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MESSRS. EDITORS—The question communicated by a subscriber, and published in the Oct. No. of the Mechanic, I have solved in the following manner:—I reduced or changed the fractions three fourths and nine tenths to fifteen and eighteen twentieths; then I added the numerators fifteen, eighteen, and thirteen together, and divided the amount by two; because each man's horse is named twice. And from the quotient I subtracted each numerator successively:

thus, 23 — 13 = 10. A's share of the numerator.
23 — 18 = 5 B's share of the numerator.
23 — 15 = 8 C's share of the numerator.
23

Now by three statements in proportion the answers are found.

thus, 23 : 26 45 :: 10 = \$11·50 A's share.
23 : 26·45 :: 5 = \$5·75 B's share.
23 : 26·45 :: 8 = \$9·20 C's share.
\$26·45

Sancook, Oct. 27th, 1832. T. J. TENNEY.

THE

# YOUNG MECHANIC.

VOL. I. DECEMBER, 1832. No. XII.

## OBSERVATIONS ON DRAWING INSTRUMENTS.

[Concluded from p. 162.]

### SCALES.

THE Sector and Gunter's scales, being but seldom used in most kinds of drawing, it is not considered necessary to give a full and elaborate description of either. They are sometimes convenient in projecting different views of the sphere, and in dividing lines proportionally. As all cases of instruments generally contain the former, it will not perhaps be amiss for the student or artist to supply himself with one, especially if he is desirous of forming a complete collection; but, if otherwise, it will hardly repay him for purchasing it, and the same may be said in regard to the latter. Considering that very few instances occur in which these two scales are of use to the practical man, we shall confine ourselves more particularly to the plane and diagonal scales.

The *plane scale* (or scale of equal parts, as generally called,) is formed by dividing a given line into any number of parts or divisions, which bear a certain relation or proportion to the divisions of another given line, larger or smaller than the former. For instance, suppose we wish to make a length of three inches express on paper a line of three feet; it is evident that if we divide the three inches into three parts with our compasses, each of these parts will represent a foot or one third part of the first line. Thus if we subdivide each of these third parts into twelve parts, each of the parts so found will represent a twelfth part of a foot, or an inch; and we may take two, four, six or ten, or any number of inches, or parts of inches, and divide and subdivide them in the same manner, in any given ratio or proportion to another line. This will serve to explain fully the method of constructing this scale, which is used by the draftsman, and by the help of which he is enabled to lay out his plan in any proportion. As it would be extremely inconvenient and difficult to form a new scale on paper for every drawing which is made, various scales of inches and parts of inches are cut on a thin piece of ivory, which is denomina-

ted a *scale*, the best kind being about thirteen inches long, and having on them scales of two inches, 1 3-4, 1 1-2, 1 1-4, Inch, 3-4, 1-2, 1-3, 1-4, 1-5, 1-6, 1-7, 1-8, 1-9, 1-10, subdivided into tenths and twelfths, as in figure 1, the twelfths being in the lower line and the tenths in the upper. The smaller scale which is usually contained in the common cases of mathematical instruments, has a protractor on one side and a few scales on the other, but as this is a cheap article, we scarcely ever find them accurate, and as it is an instrument on which we place so much dependence, we cannot be too careful in our selection of it. A small error may not be perceived in transferring a few distances to paper, but in a large plan a succession of these small errors soon produces a very perceptible one, and we should be continually subjected to the alternative of erasing all we had done from the paper, and beginning anew, or of proportioning the error, as near as we can judge. among the different lines. In plotting field work, every thing depends on the accuracy of construction of the scale and protractor. When a rule is used, it should never be laid on the table or drawing board, and the compasses pressed upon it, as they are very liable to slip and thus scratch and deface the divisions, but it should be held in the left hand, and setting one leg of the compasses in the division which denotes one extremity of the line to be enclosed in them, allowing them to bear only by their own weight, the other leg is to be extended by the middle and fore fingers, so as to comprehend the intended distance. In this way, by careful usage, a scale may be made to last a great many years.

For surveyors, scales of about a foot in length, with both edges champered and graduated into tenths, twentieths, thirtieths, fortieths, &c. of an inch, are of great utility, as they may be laid on a line, and any distance pricked off from the edge, and when a number of distances are to be transferred in one continued line, it can be done much more accurately in this way than by the compasses. These scales generally come in setts of three, four or six, packed in a small case, which sometimes contains in addition a triangular piece of ivory, having a mark or marks on the hypothenusal side, the use of which is to convert the scales into a sort of parallel ruler, by which any number of lines may be drawn parallel and at very small distances from each other. Buildings or other objects or plans may be shaded in lines in a very regular and beautiful manner by it. To use it, one of the sides adjacent to the right angle is set against any line to which others are to be drawn parallel, as the side of a square for instance. The edge of one of the scales is then applied to the hypothenuse and a division brought to coincide with the mark on it. By confining the scale down upon the paper by the hand or otherwise, the triangle may be moved along its edge so as to bring the mark in contact with all the divisions, and in proportion as the triangle is slid from right to left, or the reverse, the edge against the side of the square recedes from it. A scale and two rulers opening on a joint like a sector, may be contrived in a similar manner to shade cylindrical, elliptical, parabolic, or any kind of curved surfaces. In order to do this,

suppose we have a rectangle on one plan which we wish to shade by lines, so as to represent a cylinder ; if we in the first place graduate the outside edge of one of the rulers according to the difference of the sines of the angles of a quadrant or semi-circle, the arcs of which have a due relation to the intensity of the shade on the surface of the cylinder, we can divide the surface of the rectangle in the same proportion, by applying the edge of the other ruler to the side of the rectangle, and bringing up to the graduated edge of the former, a scale which has a certain division on it denoted by a star or any mark sufficient to distinguish it from the others, (it will be perceived that the divisions are placed on one of the sectoral rulers so that they may be used against any straight edge having a divisional mark on it, thus forming the instrument complete in themselves) and opening the rulers so that when they are slid along till they meet the opposite side of the rectangle, the star mark shall correspond to the other extreme division of the graduations. As an instrument of this kind has never been noticed by any author it may be called a *sciagraph.*

Fig. 1.

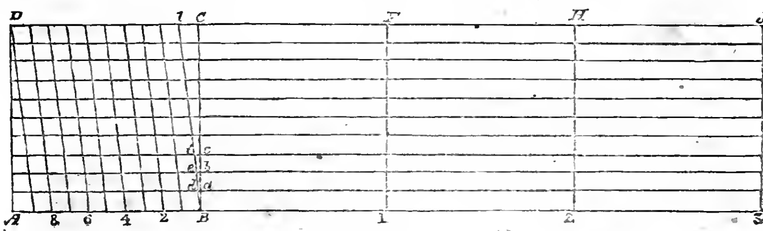




Fig. 2.

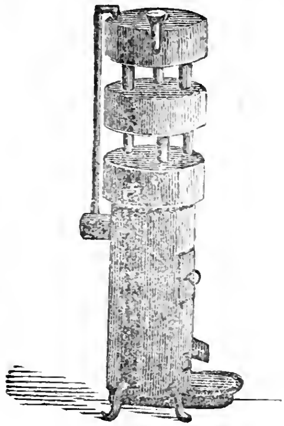
*The Diagonal Scale.*—No scale has as yet been constructed which exceeds in accuracy or simplicity this. By it an inch can be divided with ease into one thousand parts, and any measurements, to that degree of fineness, removed by the compasses to paper. To make it, we first take any line, A B, fig. 2, equal to 1-2, 1-3, 1-4, or any other fractional part of an inch, and erect upon it the square or rectangle A B C D. We then divide A B into four, six, eight, or ten equal parts, ten being generally used on the ivory scales. Having done this we likewise divide D C into the same number of parts, and A D and B C are to be divided similarly. Produce the line A B, making B 1 equal to A B=1-2=2-3. Draw through the points *a b c*, on the line B C, the lines *a d*, *b e*, &c. parallel to A B. Join the 0 point of the line A B to the point 1 on C D, by the line B 1 ; and draw the lines 1-2, 2-3, 3-4, &c. parallel to it, and the scale is complete. Now B C being divided into ten parts, and c 1 being 1-10 of D C=1-10 of A B, the triangles *d a* B, *e b* B, *f c* B, 1 C B, are similar, and their homologous sides pro-

portional; that is, B C : 1 c :: B *a* : *d a* :: B *b* : *e b* :: B C : *f* c. But B *a*=1-10 B C and B *b*=2-10 B C and B *c*=3-10 B C, therefore *a d*=1-10 C 1=1-100 A B, *b e*=2-10 C 1=2-100 A B. Again, suppose we divide A B into eight parts and B C into four, six, or twelve parts, it is evident that we might thus get 1-32, 1-48, 1-96, or any other part of A B. Supposing the line A B to be the unit of the scale, if we wish to take a unit and a tenth, or two, three, &c. tenths, we have only to set one leg of the compasses on 1, and move the other leg to intercept any of the divisions of A B, according to the number of tenths to be taken. If units, tenths and hundreths are required, set one leg on 1 F, if one unit is wanted; if two or three, on 2 H or 3 J, and move upwards to the first, second, third or fourth parallel, according to the number of hundreths. Extend the other leg to the intersection of the line B 1 with the assumed parallel, and the number of units, and hundreths is contained in the points of the compasses, and by extending it still farther on the same parallel, you may take in any number of tenths. It is on these principles that all the diagonal scales are formed, but owing to the space which they take on the ivory, we seldom find more than four on any scale, these giving the 1-100, 2-100, 3-100, 4-100 parts of an inch.

In conclusion, a few observations may not be amiss upon the *magazines* or cases in which the instruments are packed when not in use. The boxes for this purpose are usually made of mahogany or other suitable hard wood, the larger sort having one or two drawers for the larger instruments, such as *Elipsagraphs*, *Protractors*, &c. and the other part being for the smaller kind, as compasses, pins, &c., the scales being confined in the upper part or lid by small buttons or other proper fixtures. As every one will suit his own convenience in regard to form, dimensions, &c. no particular plan can be recommended. The inside should always be covered with soft velvet or cloth, and divided by small partitions for the different instruments, which should never be thrown into a box or drawer promiscuously by themselves, as they are very apt when lying together in this manner to abstract moisture, and soon become oxidated. Before the steel drawing pens and other instruments are laid away, they should be very carefully freed from all ink or perspiration which may adhere to them. The box when not in use, ought always to be closed, that the dust may not collect on the instruments and get into the joints, causing them to wear loose and uneven. Care should be taken to keep the scales separate from the other instruments, that they may not be scratched or defaced.

Having finished this subject, the writer may at some future period extend his remarks to Plain Drawing. R. H. E.

## FESSENDEN'S STEAM STOVE.



The principles of this invention consist in forming an easily *portable apparatus*, which furnishes convenient modes of arresting and detaining much of that heat produced by fire for warming apartments, which in common stoves is suffered to escape through the smoke pipe and chimney. This is effected by exposing as large surfaces of water, inclosed in proper metallic vessels, as is conveniently practicable to the action of the heat of the fire-place, distributing the caloric, thus detained, within the apartment to be warmed, and condensing and bringing to the boiler, the steam thus arising, without the apparatus of valves, syphons, &c. &c. heretofore thought indispensable in heating by steam.

The apparatus which constitutes my Steam and Hot-water Stove, consists of a hollow cylinder, standing perpendicularly on short legs. Within this cylinder are a grate, an ash-pit, and a fire-place, with proper doors to admit fuel, take away ashes, &c. Directly over the fire place, and also within the cylinder, is a boiler; and over the boiler two or more flat cylindrical vessels, (as represented above,) fitted with tubes to receive steam from the boiler, and yield heat to the air of the room. The tubes forming the channels of communication between the boiler and the receivers, terminate within the latter, two or three inches above their bottoms; by which means water is retained in the lower parts of the receivers, while their upper parts are heated by steam. The extra steam not condensed in the receivers is carried off by a small tube leading into the smoke pipe.

Although I have adopted, for the most part, in my Patent Stove, apparatus, similar in shape and component parts to that figured and described above, yet its form and proportions may be varied indefinitely. And as the Patent Act declares that 'changing the

form and proportions of any machine in any degree shall not be deemed a discovery,' I shall hold the unlicensed adoption of the *principles* of my stove, under any possible form or modification, to be a violation of my patent right.

*Directions for using the Apparatus.*

In putting the stove in operation, it is necessary, before kindling the fire, to turn water into the tunnel at top till it fills the boiler and will run out at the cock, and a quart or two more, as an allowance for waste. The cock answers as a guage to ascertain when there is a sufficient quantity of water in the apparatus ; and when there is much fire kept in the stove the cock should be turned several times a day, and if no water escapes, more should be turned into the tunnel. But the receiver in which the cock is placed should never be filled quite full, for in that case the water in boiling comes in violent contact with the top part of that receiver, and not only makes a disagreeable noise, but strains and endangers the vessel in which the ebullition takes place.

The above is the Inventor's account of the stove. In a pamphlet published by him there is a number of recommendations from gentlemen of respectabillty, who speak of it as a valuable invention. That some of the heat must be arrested, and conveyed to the room by means of the water and steam, instead of passing up the flue, appears evident. The quality of the heat also must be influenced by the heat of the surface to which the air of the room is exposed. For example, the air exposed to the surface of a vessel containing water and steam at 212°, is better for breathing than the air exposed to a red-hot cast iron stove. The only difficulty that we know of, is, that the tin vessels heretofore used are not so durable as might be desired, and it is probable the inventor cannot perfect his stove without using cast iron vessels.—EDS.

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## PATENTS FOR MASSACHUSETTS,

GRANTED IN MAY, 1832.

For a machine for *Making Coopers' Rivets* from iron, copper, or other metal ; George W. Soule, New Bedford, Bristol county, Massachusetts, May 11.

The heated metal which is to be made into rivets is passed between two iron rollers, grooved so as to reduce it to the size of the shank of the rivets, and the metal is received by an apparatus which cuts off and heads it. From the nature of the machinery its description would require drawings to make it understood. The claim is to every part of the machine, with the exception of the grooved rollers. The description, as given, is obscure, and the drawings themselves are not well executed.

For *Paper for covering Buildings;* Frederick A Taft, Dedham, Norfolk county, Massachusetts, May 11.

Paper is to be made by taking finely ground coal and sulphur, and mixing it intimately with the pulp, after which the sheets are formed in the usual way. After the paper has been dried it is to be passed between heated rollers, which will melt the sulphur and render the paper impervious to water. Other materials are to be sometimes employed for the same purpose, and the paper, instead of being rolled, may be pressed between heated plates, or put into an oven.

The proportionate quantities of the materials employed, may be one part, in weight, of fibrous stock, two and a half of brimstone, and two of coal. Salt and lime are sometimes added, to render the whole less combustible.

For an improvement in *Andirons;* William Wilson, Greenfield, Franklin county, Massachusetts, May 16.

In this andiron, the front or upright part, and the bar and back foot part, are made separate. They are to be put together by means of a wedge-formed dovetail on the front end of the bar, which falls into a corresponding recess formed by projecting cheeks on the back of the upright part.

The advantages of this mode of forming are said to be facility of packing; more easy manufacturing; increased strength, and economy in use, especially when made of cast iron, as one part can be renewed when the other is broken or burnt out.

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## BOTTOMLESS PRIVIES.

Messrs. Editors—All persons who love pure water, should examine their privies and ascertain if they are without tight bottoms. If they are, the strong probability is, that the wells, in the immediate vicinity, are in some degree tainted. One gentleman in this city, (who is an extensive owner of real estate,) informed me that one of his vaults had not been emptied for six years, although it had been, during this time, in constant use. There being no artificial bottom to this vault, the fluid contents had filtered away, through the soil, as fast as they had been put in. But as there was no well so near as the neighboring cellars, the latter places received the *pure* and *healthy* streams from this *underflowing* fountain. I can point to a number of vaults in this city, (and I presume there are hundreds,) without any bottoms, except the natural soil: and this is in many instances extremely porous. It seems to me, Messrs. Editors, that this method of constructing privies is an evil of sufficient magnitude, to deserve the attention of municipal legislation.

Yours Respectfully,

BOTTOM.

From the Journal of the Franklin Institute.

## COATING LEAD PIPES.

*Specification of a patent for Coating Lead Pipes with Tin. Granted to Thomas Ewbank, city of New-York, May* 18, 1832.

To all whom it may concern, be it known, that I, Thomas Ewbank, of the city of New-York, have invented a mode of coating lead pipes with tin, in a more effectual manner than has been heretofore done, and by which the danger attending the use of such pipes for the conveyance of water, and other liquids, is obviated, whilst their cost is but little enhanced ; and that the following is a full and exact description of my said invention.

I take the lead pipes, *after they have been drawn to the required size*, and I coat them with tin, either on both sides, or on the inside only, as may be desired. To do this I prepare a bath of melted tin, in a vessel of a suitable form and size, which may vary according to the size of the pipe to be tinned. I regulate the heat of this bath, so that the tin shall continue in a fused state, without becoming sufficiently heated to melt the lead. This may be ascertained either by the use of a thermometer, or by testing it by a piece of lead, or by such a mixture of lead and tin as will fuse at a given temperature : with a little experience, however, a workman will not find any difficulty in accomplishing this object without such aids. When the pipe is to be tinned on the inside only, I cover the outside with lampblack and size, or with any other article which will prevent the action of the tin upon it : I then blow powdered rosin into the pipe. When it is to be tinned on both sides, the rosin is to be blown, or otherwise passed into the pipe, and the outside also is to be sprinkled with it, and it is then ready for the process.

The melted tin should be kept covered with rosin, fat, or other suitable article, to prevent its oxidation, and to aid in the tinning. All that is necessary is then to pass the pipe through the melted tin, which, when the pieces are not of considerable length, may be easily managed by hand ; or when of considerable length and weight, a rope and pulley, or any other suitable mechanical contrivance which the workmen may prefer, may be resorted to.

I am aware that the coating of lead pipes with tin, simply, is not new, the same having been heretofore done, but in a manner less perfect than that which I have just described. The lead has been tinned in sheets, and afterwards made into pipes, or the pipes have been made and tinned, and afterwards drawn to the intended size. By neither of these processes, however, is the intended security obtained with the same certainty as by my process of tinning the pipes *after* they are otherwise finished. The coating of tin is thus rendered more perfect, and those fissures are avoided which the former processes can scarcely fail to produce

I do not therefore claim as my invention the mere tinning of pipes, made out of lead, but what I do claim is the tinning such pipes after they have been drawn to the proper size, as is hereinbefore set forth. THOMAS EWBANK.

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From the Register of Arts.

## PROPELLING VESSELS.

*Patent to W. Hale, Machinist, for improvements in machinery for Propelling Vessels, granted Oct.* 13, 1831.

THE improvements in propelling proposed by Mr. Hale, consist in driving water forcibly out at the stern of the vessel under the water line, by means of a rotatory apparatus, somewhat similar to the rotatory blowing and winnowing machines.

In the 5th volume of the present series of the Register of Arts, p. 67, we have given a description of a patented invention of Mr. William Hale, for raising or forcing water for propelling vessels, and the present patent has been taken out for a modification of the same method, therefore we refer our readers to the former description to obtain a general idea of the plan.

In his second patent Mr. Hale makes the exterior casing of the paddle box to recede from the centre spirally, constituting a curve whose distance from the centre of motion at its outer extremity exceeds the distance at its inner extremity by the space or opening made for the escape of the water from the box. The water is admitted into the box through openings near the center, in the manner usually adopted for the supply of air to the blowing machines. The propellor, or vane, which puts the water in motion through the medium of a steam engine, or other first mover, consists of a single lever receding spirally from the axis, or centre of motion. The motion of the vane is in the direction to cause the water within the box to recede from the centre, and escape finally in a direction which is a tangent to the curve; or its motion is towards its back, or that part farthest from the centre. The patentee does not however confine himself to the spirally formed vane, but proposes several other modifications of the moving or propelling part of his invention; such as placing a series of oblique paddles or propellors on arms extending from the centre of the apparatus, as in his former patent: and these he again proposes to vary, according to circumstances, in number, magnitude and position.

This propelling apparatus is placed near the stem of the vessel with the axis in a vertical posirion, and the opening at the circumference of the paddle box made to communicate with the water in which the vessel floats through an opening in the stern, while the openings near the centre of the box are made to communicate with the exterior water through the bottom of the vessel.

The application of the invention to raising or forcing water, is effected by connecting the induction openings with the well or reservoir from which the water is to be raised, and a delivery pipe with the eduction opening, and thus the machine becomes a rotatory pump.

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Messrs. Editors,—A part of my answer, in your last number, was so erroneously printed, as to be quite unintelligible. Will you please insert the following?

A 9,25 3-4, B 10,58, C 6,61 1-4. A and B did 3-4 of the work. C 1-4 or 5-20. B and C did 13-20, therefore B did 8-20, and A the remaining 7-20. A and C did 6-10, and not 9-10, as stated in the question.

According to Mr. Tenney's answer, A and B did 15-23 of the work, A and C 18-23, B and C 13-23, which fractions, when reduced to a common denominator with 3-4, 9-10, and 13-20, will not be found equivalent with them, as they ought to be, to meet the requisitions of the question.

R. S.

The form which contained this answer went to press without the particular inspection of the person who has charge of the questions, on account of his indisposition. We shall be more particular hereafter.—Eds.

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## NOTICE TO CORRESPONDENTS.

The answer of 'No Schoolmaster' is received, but was mislaid until too late for this number. Cymro's Formula is under consideration. J. R. C.'s communication will probably appear in our next. J. H. B. will please to send the first part of his proposed series by the 1st of January. J. M. W.'s reply to Philo is too late for this number. We regret this, as it would have been better to complete the controversy in the present volume. The question of C. will appear in our next.

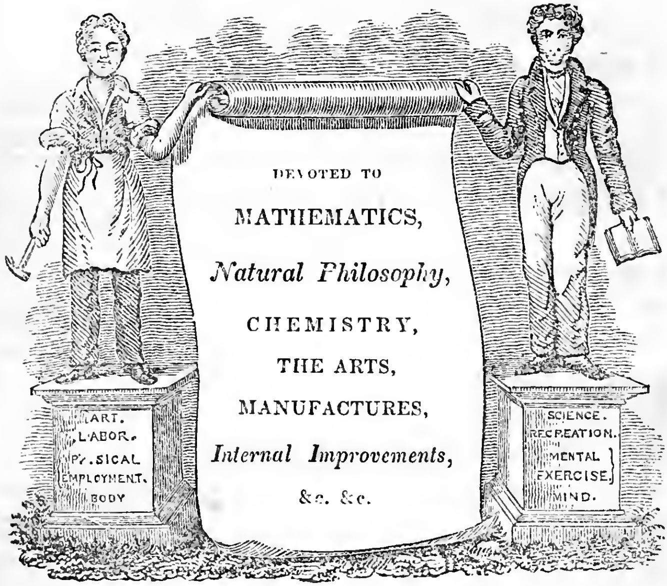
# INDEX TO VOLUME I.

THE

# YOUNG MECHANIC.

CONDUCTED BY

AN ASSOCIATION OF PRACTICAL MECHANICS.




To promote one's own pecuniary interest is well—to promote that of one's neighbor at the same time is better—but to enlarge the powers, increase the energies, and improve the condition of a very extensive population, in conjunction with the two preceding objects, is best of all.—TENNANT.

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VOLUME II.

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BOSTON:

PUBLISHED BY GEO. W. LIGHT.

Lyceum Press—3 Cornhill.

1833.

# TO THE PUBLIC.

In presenting the last number of the Young Mechanic for this year to its patrons, the Association under whose control it is issued, have a few statements to make.

The delay of this number, has been occasioned by an uncertainty with regard to the continuance of the work. The association, having labored gratuitously for it since its commencement, and besides incurred some loss in its publication, considered it against their duty to pursue the object farther unless an arrangement could be made to place the work upon a more firm basis. This they had learned could not be done without enlarging it, making a variety of improvements, and raising the price. They stated the case to several spirited individuals, and they are happy to say that a number of responsible persons have declared, not only by words but by actions, that there *shall* be a Mechanics' Magazine published in the metropolis of New England. A proposition has been made to procure a *fund*, by donations and shares in the proprietorship—as there must be capital in order to make the work what it ought to be—to be called the Mechanic Fund, the surplus of which, if there shall be any over and above what is wanted to insure the success of this work, to be devoted to the encouragement of mechanical genius, or to the improvement of mechanics in some other way. This proposition has been met promptly and liberally by a number of individuals, and there is a fair prospect that a work containing at least double the present

quantity of matter, and well conducted in all its departments, will be placed upon a permanent foundation. The first number will probably appear in January. In the mean time, we would request all who are friendly to the improvement of the operative classes, and especially to the present object of the Association, to aid the forthcoming work, by donations to the fund, by inducing others to subscribe for it, or at least by their own subscriptions. We trust that all our present subscribers will not only continue their patronage, but render us some assistance in circulating the work as widely as possible.

Donations or subscriptions may be directed to T. CLAXTON, 23 Water Street, or to GEO. W. LIGHT, Publisher, 3 Cornhill, Boston.

Boston, December, 1833.

THE

# YOUNG MECHANIC.

JANUARY, 1833.

For the Young Mechanic.

## SCIENCE AND ART.

We are indebted to what has been emphatically styled the *reformation*, for the light of truth in the natural and intellectual world. Previous to that eventful period, the dogmas of the church held in fearful control men's minds and consciences, and none were allowed to think or act but in subserviency to papal dominion, and monkish superstition. Had not some bold and enterprising geniuses arose, regardless of every authority but reason and common sense, the world would, at this very day, have been enveloped in a darkness worse than that of Egyptian—a darkness that would have obscured every ray of light in the human mind. Independence guided the course of those bright luminaries in science, that dispelled the clouds of superstition and bigotry in the moral and scientific world: such as Kepler, Gallileo, Copernicus, Bacon, Newton, Locke, and a hundred others, distinguished for depth of reasoning and profound research. Bacon took the lead, and in his *Novum Organum* [New Organ] he delineated a new path for the human mind to travel, which would infallibly lead to accurate and definite results. This admirable production gave an impetus to mind, which placed it beyond the tramels of sophistry and syllogism, and established it on the permanent basis of induction. This puts nature to the test, by a thousand trials—incorporates into one vast intellectual machinery the whole visible creation—gives a revelation to those secrets, which, in spite of syllogism, had lain dormant for ages—and, by this discovery, arts and sciences have

been originated, improved, and perfected, to the infinite advantage of mankind.

It is worthy of remark, that, at the time the *Novum Organum* was ushered into existence, the world had seen no model of inductive reasoning, whence its rules might be drawn with amplitude and precision. Poets had sung, and orators declaimed : their arts were perfected before Aristotle had described them. His rules were inferred from the most perfect models of those arts. But the art of interpreting nature in all its windings and sinuosities, was but imperfectly understood, when Bacon, with an uncommon energy of intellect, delineated its features, and described its proportions. His modesty was commensurate with his wisdom and talents. It was not his aim, as it was that of his predecessors, to establish a new sect, and thus immortalize his fame in the annals of a party. He was influenced by more exalted motives, and more animated views. His design was of a more laudable and glorious nature ; no less than to instruct the world, to unrivet the shackles of mind, to follow nature in her simple attire, and to point out the true method of philosophizing. With a boldness characteristic of a genius of the first order, he delineated a new chart of knowledge. Unawed by imprisonments, and the anathemas of the church, he undauntedly stood forth in opposition to a world of religious bigotry, and laid the foundation of the true philosophy. This has received the adjusting hand of the immortal Newton, who has examined it with the scrutiny of mathematical research. Since Newton's time, the arts connected with natural philosophy, have rapidly progressed. The last and the present century have been eminently distinguished for important inventions and discoveries. We live, physically speaking, in an age of wonders. Humanity has its friends ; choice spirits of genius have exerted themselves, and are still active in the diffusion of knowledge, and at no time has their influence been so extensive as at present. At a time when the voice of the warrior is silenced by the bland and gentle sounds of the arts of peace, in Europe and America, the whole civilized world is turning her attention to the cultivation of literature, science and art. England, with her immense resources, is annually exhibiting new constellations, whose rays are diffused through the intellectual and moral world. The republic of letters is enlarging its boundaries—genius, in whatever clime reared, or to whatever creed belonging, is courted, patronized, and encouraged.

Canal and steam navigation have opened a new source for philosophical investigation, and the railway system, with locomotive engines, is attracting attention in every part of our country. For the successful prosecution of these varied objects, extensive mathematical and physical knowledge is required. The period will soon arrive when the whole fund of American genius will be put in requisition to keep pace with the enterprise and demand of our citizens. The extensive territory which we inhabit, the innumera-

ble resources with which Providence has blessed us, and our fathers purchased and bequeathed to us, are a sufficient guarantee for a remuneration of our labors in the acquisition of science, and for the time spent to compete with the rapid march of improvement.

No nation ever enjoyed such extensive physical advantages as America. The God of nature has been exceedingly bountiful, and, as faithful stewards, we have improved our talents. We have not only had our full share of inventions, but we have readily adopted and improved those of other nations. No new machine is constructed, no new application of principle is made in England, but almost simultaneously it is adopted in America. Every improvement in the arts in England, is, as by magic, transferred across the Atlantic, and extensive and profitable establishments made in America, long before the principles are scientifically understood by nations within a few leagues of the English coast.

The following statement redounds much to the honor of American genius and enterprise.

Sixty years ago, the genius of Mr. Watt constructed the steam engine, the most wonderful of those auxiliaries which science has furnished to aid the powers of man. The distance from England to France is only twenty-one miles. Such an important improvement might have travelled to the latter country in a very short time, and, one would have supposed, before it had measured half the distance of the Atlantic. But it so happened, that while her men of science have explained its theory and eulogised its usefulness, her manufacturers have been in no haste to avail themselves of its power. Her artizans in general have remained ignorant of its construction. America has produced only two or three treatises on the theory of the steam engine, and not *one* before she had applied the theory in all its bearings ; but she has done better. The art was not long practiced in England, before it was transported across the Atlantic to Philadelphia, there much improved, and many years before the steam engine was known in Paris, it was made in the highest perfection on the west side of the Allegany mountains, at Pittsburgh, a town which scarcely existed when Mr. Watt made his discoveries.

Nearly the same remarks will apply to steam navigation. America caught it, improved it, sent it to England, a new and perfect art of boundless utility and power. What had France been doing, while England and America had been reciprocating improvements? The men of science, who surrounded the French government, had made steam navigation the subject of prize essays, and ingenius speculations. Much had been written, and the powers of the *integral calculus* exhausted in illustrating high and low pressure, centres of percussion, and planes of resistance. In the mean time the rivers and coasts of France were navigated by vessels built after the model of the fifteenth century ; and were without a single steam boat, when nearly three hundred were plying on the rivers and coasts of America. J. R. C.

## CHEMISTRY.

The following communication is from a practical chemist. Arrangements are made to publish his manuscripts, with such elementary principles as he may deem necessary. We have commenced with an article on Light.—Eds.

For the Young Mechanic.

Messrs. Editors—In some early numbers of the Young Mechanic, I noticed a few pages devoted to exemplifying some of the first principles of chemical science; in which its object, the laws of attraction, and the phenomena of heat, were treated. The numerous and various advantages to be derived by all classes of society, in every profession, from a knowledge of chemistry—the wide field it offers for agreeable amusement—the knowledge it affords respecting the natural laws—and its power of disciplining many powers of the mind—induced me to hope that the subject might be continued, and in such manner that all these purposes might be effected, while its main object, that of rendering it practically useful to those for whom the pages of the magazine is intended, should be constantly kept in view.

Notwithstanding the many valuable works on chemistry, great difficulty is found by those engaged in chemical experiments, and more particularly by those unacquainted with the science, or such as cannot command an extensive library, in obtaining, at all times, the particular knowledge of which they are in pursuit; thus in obtaining some one or more of the properties of a body, many volumes may be looked over before the knowledge is obtained, and with those who have frequent occasion to make such references, their search will frequently be unavailing. In addition to this, there are few works on chemistry which have not some statements calculated to lead those unacquainted with the subject widely from the truth. I allude principally to those statements to which the mechanic and manufacturer have most occasion to refer; nor is it to be expected that the theoretical chemist merely, should be acquainted with the difficulties, comparative expenses, &c. of the application of the processes he describes, on an extensive scale; yet much might be done, and much would be undone, were our works on the subject to proceed more from the laboratory, and less from the closet.

Having myself experienced much difficulty and frequent loss of time, for want of a systematic and complete work to refer to, I, a year or two since, commenced one, with the hope that it might, in some degree, obviate the difficulties before mentioned. The method pursued was to give, first, the most important information to the student and experimenter, and afterwards those of less importance; thus facilitating the progress of the student by enabling him to take at pleasure a detailed or more general view, but

more particularly to render it of easy reference to the experimentist and the artizan. Thus far the principal portion of experiments mentioned, have been repeated, and when any thing new in itself, or differing from former statements, has been advanced, it has been confirmed by repeated experiment and severe scrutiny.

I have been thus particular in stating the object for which the manuscripts I possess, and am now engaged with, are intended, in order that you may judge of their fitness for insertion, in monthly numbers, in the magazine. Should you deem them so, I shall, after treating briefly on the elements of this science, which are most important, proceed with my manuscript before mentioned, and shall be fully compensated, if I am able to do any thing towards assisting the artizan in his profession, or diffusing more widely a knowledge of the natural laws.

J. H. B.

## LIGHT.

This is one of the great powers which produce and influence chemical phenomena. A general history of the effects produced by light, belongs to the science of optics. Some of its properties, however, it is necessary should be understood, in order to acquire a correct knowledge of chemistry.

Light is generally spoken of as matter. The question of its materiality is by no means settled.

The hypothesises invented to account for the operation of light and caloric, are two : one, that the universe contains a subtle elastic media, the vibration of which produces the effects of light ; the other, that particles are sent off from luminous bodies, which enter into and change the composition, or communicate their motion to bodies. The latter was the opinion of Sir Isaac Newton, and he has put the query, whether light and common matter are not convertible into each other.

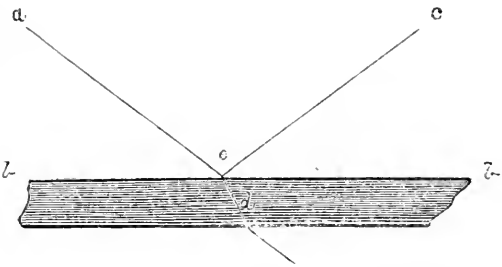
The principal source from which our globe receives light, is the sun. It is also the result of combustion, chemical action without combustion, electric and voltaic action.

The motion of light is progressive ; it has been found to require about seven minutes to come from the sun to the earth—hence its velocity is about 200,000 miles in a second.

It moves in straight lines. If a ray is bent, it is always at an angle.

It passes unequally through different substances ; by some it is wholly interrupted. Those through which it passes, are said to be transparent, and those which intercept it are said to be opaque.

A ray of light (*a*) suffered to fall obliquely upon a plate of glass, (*bb*) a portion (*c*) will be reflected ; the remainder (*d*) which passes through the glass will be refracted towards the perpendicular.




The portion reflected may be transmitted, and the portion transmitted, reflected. This and similar phenomena are ascribed to certain poles, which the particles are supposed to possess, being differently directed at different times. Hence the term polarization of light.

The angle of incidence (*a bc*) is always equal to the angle of reflection (*cbc*.) The degree of refraction is in most cases proportionate to the density. Inflamable bodies, however, possess the power to refract light in an eminent degree. A knowledge of this fact led Sir Isaac Newton to infer that the diamond contained combustible matter, an opinion which has since been confirmed.

Light is capable of division, by being passed through a triangular prism of glass, into seven colors.* The names, the proportions of the spectrum which each occupies, and the order of their refrangibility is as follows :

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|---|---|
| Red | 45 |
| Orange | 27 |
| Yellow | 48 |
| Green | 50 |
| Blue | 50 |
| Indigo | 40 |
| Violet | 80 |

Besides the *colorific* rays (those before enumerated) there are others, which have received the name of *calorific*, or heating, and *chemical* rays. It has been found that the greatest heat is produced without the visible spectrum, beyond the red ray ; and the greatest chemical changes have been found to be produced immediately beyond the violet ray.

The rays thus separated by the prism are incapable of further division. Collected by a lens, they reproduce white light.

Diversity of color is supposed to be owing to the absorption of some rays, and the reflection of others ; thus, all the rays being absorbed by a body, but the red, that ray, being reflected by the

* The separation of the rays is occasioned by the difference of refrangibility. A very good prism for this purpose, may be made of three strips of window glass, about five inches long and 1 1-2 wide, by cementing them together at the edges, closing the ends by triangular pieces of wood, and filling with water.

body, would produce in us a sensation to which we give the name red.*

Light possesses an important chemical influence. Not only the color, but the pungent and aromatic properties of vegetables, are, in a great degree, owing to light. Advantage is taken of a knowledge of this fact by gardeners, in rearing cellery. Excluded from light, it is mild and white, but acrid and poisonous if not thus excluded. Some chemical compounds are decomposed and otherwise altered by light, as will be shown hereafter. A solution of salt, ready to chrystallize, if placed in a vessel, one side of which has been darkened, it will be found that chrystallization will commence on that side left uncovered.

The action of light upon animals, is not less important or powerful than upon vegetables, as may be shown by comparing worms, grubs, and those animals which live in the ground, with those exposed to the light. Among men, also, great difference is to be found between those who are confined within doors, and those whose occupation requires their exposure to the sun.

Beside the effects mentioned, it has been advanced that light has the power of magnetizing needles. According to Mrs. Somerville, who has made numerous experiments upon this property of light, sewing needles exposed to the violet ray for about two hours become magnetic ; exposed to the indigo, the blue, and the green, the same effect is produced, though in a less degree, while the remainder of the rays do not effect any change.

Some bodies have the property of emitting light in the dark, after having been exposed to the sun's rays. A diamond thus exposed, and covered immediately after with wax, will emit light, upon the wax being removed, in a dark room. Several artificial substances which possess this property, will be mentioned hereafter.

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For the Young Mechanic.

## PATENT OFFICE.

Messrs. Editors—I have never visited the patent office ; but from what I can learn of those that have, it must be a rich treat to persons of an ingenious turn of mind. Comparatively few persons however, who would be likely to profit by the examination of the

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* The ideas of color, excited in different individuals by the same object, are very different. Dr. Spurzheim mentions having known many instances in different parts of Europe ; among them a whole family who could distinguish only black and white. The color of chlorine to me appears yellow—to most persons a greenish yellow. By candle light, pink and yellow appear alike. In the Ph. Tr. 1777, mention is made of a gentleman, who bought and wore a scarlet dress, supposing it to be drab, and still was a good judge of pictures. An interesting article, by Mr. Dalton, describing his own vision, may be found in the Edinburgh Journal of Science, July, 1831.

models deposited at Washington, are able to go there for that purpose; and, further, I understand that but a small proportion of the models are worth examining; and among such a multitude of materials, good, bad, and indifferent, the mind gets so bewildered that unless a person can devote considerable time to the examination, he is but poorly paid for the loss of time and expense necessarily attendant on a journey of five hundred miles or more.

In conversation with a friend on this subject, some months ago, a plan was suggested which, if carried into effect, would bring the benefits of the patent office within the reach of every ingenious man. The plan is this. Let the best of the models be selected, and duplicates made from them. Say one for each State. Let these models be transmitted to the Governors of the respective States, so that in the capital of each State we may have a deposit of what is most useful in the patent office.

There is every year considerably more money received into the Treasury, on account of patents, than is expended. To what better use could this surplus money be appropriated? Suppose ten models were selected annually, and thirty made from each, or three hundred in all. At ten dollars each, they would amount to three thousand dollars. There are about three hundred working days in a year, exclusive of holidays, so that a model would be a day's work on an average. If a foreman, at eight hundred dollars, and two other mechanics, at five hundred dollars each per annum, were employed, there would then be twelve hundred dollars left for materials, &c. It would probably cost two thousand dollars for a good set of tools, suitable for such an establishment.

Would not this be a good school were many an ingenious young man would be glad to work a year for what he could learn? If so, there would be no want of help—but there should be at least three permanent hands. The models produced in this way, would be much better made than the original ones, and, by making a number of the same kind, the expense would be much less. By those models being scattered into the different States, they could not all be lost by any casualty by fire or otherwise, and these little nests of models might serve as a nucleus in each State, around which the products of the ingenuity and skill of its own inhabitants might be collected. PHILO.

For the Young Mechanic.

## GEOMETRY AND ARITHMETIC.

Messrs. Editors—Although there is no royal road to Geometry, and whoever masters this subject must do it by a great deal of patient study, yet I believe for practical purposes, we may learn enough to enable us to get along very well, without straining our mental powers to any great extent. I intend, if agreeable, to give a few essays on this subject, which I hope will be useful to our Young Mechanics. And, as Geometry is seldom applied to practice without the aid of Arithmetic, I shall pursue both of these subjects in connection, and give some of their applications to the common purposes of life. It will not be necessary for my purpose to give the usual axioms, definitions, &c. at the commencement, as I hope to explain myself as I proceed.

### AREA AND BOUNDARY.

Proposition.—Figures of equal areas, if their shapes are different, the whole length of their boundary lines will be different also.

*Example* 1. Figure 1 is a square. The length of each side is equal to one inch, and its area is equal to a square inch.

Fig. 1.

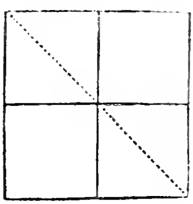

Fig. 2.

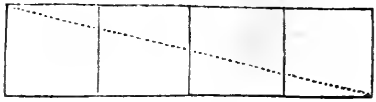

Figure 2 is an Oblong, or rectangled Parallelogram. The length is two inches, and breadth half an inch. Its area is the same as the square, equal to a square inch; but the length of the boundaries of these two figures is different; that of fig. 1 is four inches, and of fig. 2, five inches; and the more the figure differs from a true square, the greater will be the difference between their areas and boundary lines.

*Example* 2. Triangles are subject to the same rule, which may be seen by inspecting the two figures above. The dotted diagonal lines, drawn across from opposite angles, divide each figure into two triangles, each containing half a square inch; but the boundaries of the triangles, in fig. 2, are longer than those in fig. 1.

*Example* 3. Figure 3 is a Circle of one inch in diameter. Its area is rather more than three-fourths of a square inch.

Fig. 3.

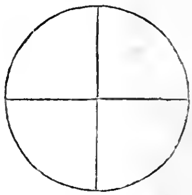

Fig. 4.

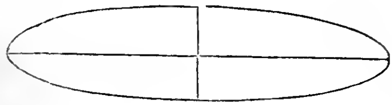

Figure 4 is an Ellipsis ; the longer diameter is two inches, and the shorter diameter half an inch. Its area is the same as that of the circle. Their areas are found by multiplying one diameter by the other, as in four-sided figures we multiply the length by the breadth. The products of one will be square inches, and of the other circular inches, which may be reduced to square inches, by multiplying them by the common factor 0.7854, which is the proportion of a circular inch in a square inch, namely, rather more than three-fourths. Although the areas of these two figures are equal, there is a considerable difference in their boundaries : that of fig. 3 is three inches and one-seventh, and of fig. 4, between four and five inches ; and the more the figure differs from a true circle, the greater will be the difference between their areas and boundary lines.

*Example* 4. The Circle is the most capacious of all superficial figures. One whose area is equal to a square inch, has a boundary of three inches and a half ; but a Square, of the same area, has a boundary of four inches.

APPLICATIONS.

1. If it would cost four dollars to inclose a piece of land, or to form any vessel whose shape is like fig. 1, it would cost five dollars to perform the same work if shaped like fig. 2.

2. If a vessel that is made round, should, by accident or otherwise, be flattened a little, or put out of a true circular form, it will not hold so much.* This would effect our measures, such as the bushel, gallon, &c. And hence the absurdity of measuring with a sack, which may be made to assume a variety of forms.

3. We find, where it can conveniently be done, advantage is taken of the great capacity of the circular form, by coopers, glass-blowers, founders, &c. The convenience, in rolling casks, and the

* The same may be said of the Square, which will be demonstrated in my next communication.

strength of them, and of glass ware, &c. must also be taken into consideration.

4. Although it is real economy to use those forms of vessels, which require the least quantity of materials in their construction, yet there are cases where it would be equally economical to adopt a contrary course. I allude to the processes of heating and cooling. A stove funnel, if made flat instead of being round, would give out more heat; for the simple reason, that the air which passes up the centre of a round pipe, is further from its sides, and cannot part with its heat so readily as it would if passing up a flat pipe. The same may be said of steam pipes, whether employed for heating rooms, or for boiling liquids, and other chemical processes. For cooling, flat pipes are better than round, for the same reason that none of the vapor, &c. is far from the sides. Brewers, distillers, gas-makers, and others, might profit by adopting these suggestions.

PHILO.

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For the Young Mechanic.

MESSRS. EDITORS—In your last number, speaking of Mr. Hale's patent, you say, 'the improvements in propelling, proposed by Mr. Hale, consist '*in driving water forcibly out at the stern of the vessel under the water line.*' As it appears, Mr. Hale's patent was granted 13th Occtober, 1831. I wish you to state that the same principle was adopted by a person in this city, and for the same purpose, in the year 1825, as may be seen by a letter in the Patent Office, which describes his invention; and was sent there for the purpose of securing the patent right to the said individual, whenever he might wish to take out a patent. Various causes have induced a delay, but not a relinquishment of his purpose. A general outline of this plan was also published about two years since, embracing the same principle, in the Evening Gazette, of this city. As I have not seen all your remarks on Mr. Hale's patent, I am unable to understand the whole of his invention, and merely wish to state, without any ill-will toward him, that the principle alluded to, in his patent, is not an original one. I hope Mr. Hale will succeed in his useful undertaking, but, at the same time, I trust he would not knowingly encroach upon the rights of others.

FULTON.

The remarks on Mr. Hale's patent, alluded to by Fulton, are by the Editor of the Register of Arts; and the patent is an English one. We would observe, with regard to the letter in the Patent Office, that the Superintendent has said that filing a caveat in that office, afforded no security, and would not prevent a patent being granted for a similar thing to another person.—EDS.

For the Young Mechanic.

## EVIDENCES OF THE ROTARY MOTION OF THE EARTH.

Messrs. Editors—A few evenings since, I attended an interesting lecture on Astronomy, delivered before the Mechanics Charitable Association, by Professor Farrar, in which he treated of the evidence afforded for believing the Pythagorian, or Copernican System to be true. Among the evidences which he adduced, in the course of his reasoning, was one, which appeared to me to militate so strongly against the received opinions laid down in works on Natural Philosophy, in regard to the laws of motion, that I have taken the liberty to place it before your readers, together with a few remarks, not merely for the purpose of cavilling, or criticising, but for the pleasure of being satisfied in regard to the truth of the statement then made. The assertion was in substance as follows:—that one evidence of the earth's revolving on its axis, was deduced from the fact, that a body let fall from some distance above the earth's surface, as from the top of Park-street steeple, would not strike a point directly under it, but would strike the earth west of that point. This doctrine is diametrically opposed to that which I have generally understood, from all other writers on this subject. If this is a fact, Dr. Arnott is certainly wrong in accusing a mariner of story-telling, because he asserted, as a proof of the fast-sailing of his favorite ship, that a sailor, one day, falling from the mast-head, fell into the water, in consequence of the ship slipping from under him, before he reached the deck. And again, that he was a foolish man, who, reflecting that the earth turns round once in twenty-four hours, proposed rising in a balloon, and waiting aloft, until the country which he desired to reach, should be passing under him. Surely, both the mariner and the projector must be correct, if a ball, falling from the top of a steeple, would strike the earth west of a point immediately under it, because the earth had turned east, during its descent from the steeple to the earth. But, instead of this, would not the sailor fall to the deck, the projector wait in vain for the desired country, and the ball fall directly to the point underneath, by obeying the law of motal inertia? To produce an effect contrary to this law, must not the sailor be free from all connection with the vessel—the man, with his balloon, beyond the attraction or influence of the earth—and the ball dropt from a point, entirely free from the action of a moving body? Grund says, in regard to this, that 'all bodies in motion have the power of imparting that motion to other bodies.' Thus, in equestrian performances, we are surprised to see a man, in leaping over garters, hoops, &c. always alight safely on the back of the horse, even when at full speed. Here is the effect of this power—the man does not spring forward, as it appears to us, but merely frees himself from the horse, when

the progressive motion he had acquired, in connection with the horse, still continues to act, and he goes forward, with the same speed, until he has reached in safety his former place on the saddle. If this is true, the 'fact' asserted by the lecturer must be incorrect, because the ball, being connected with the earth, must have acquired the same motion, and, when dropt, would still obey the same impulses, and must necessarily strike the point perpendicularly under it. It appears to me to be a serious difficulty, to determine whether the ball does strike west of the point or line, for if a plumb and line were used, it would certainly be subject to the same laws as the falling body, and therefore could be no guide.

I will not attempt to enter the labyrinth of speculation in regard to this subject, as I feel satisfied, that, by so doing, I should not arrive at any determinate result ; and, furthermore, from the well known courtesy of the gentleman referred to, I feel assured that he will not hesitate to correct any erroneous impressions which may have been received from his lectures. J. M. W.

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## ESSAYS ON KNOWLEDGE.

I have concluded to write a series of Essays for the Young Mechanic, under the above head, if they shall prove acceptable. This subject is chosen, because it will afford me ample opportunity to range over any field of knowledge which I may be able to explore. I shall commence with the following

### INTRODUCTION.

The Author of the universe wants every intelligent being to be a free and deep thinker. This is plain from the fact, that his creatures can enjoy their existence in his boundless creation only in proportion to the extent of their knowledge, and that his benevolence would be very limited, did he not give them this freedom of thought, they being unable to obtain extensive information in any other way. If this be not true, why were we endowed with the noble capacity for reading and reflecting upon the glorious Volume of Nature ; and why was it placed before us in all its magnificence, so well calculated to awaken a desire for an acquaintance with its sublime revelations ?

Every mind, just so far as it does not possess a taste for the pursuit of knowledge, is in an unnatural state. This I infer from the preceding remarks ; and I think that both the observations and the inference, upon examination, will prove to be sound. I would therefore advise every one who does not possess a taste for study, to reflect upon his situation as a member of the universe of Jehovah ; to reflect upon the time he has wasted during his life in useless employments, which were calculated to blunt his natural sensibilities ; and to resolve for the future to let his conduct be more worthy of the exalted place which he holds in this splendid creation.

I look upon the people of this world as a class of scholars in one of the great school-rooms of Deity. The only reason why all are not good pupils, is the wrong practices of the world—as is hinted in the advice just given ; and these practices have debased the mind so as to lead it to all the low, grovelling pursuits which are common in the world. But the prospect that the great body of the people will, at some future period, be roused to the exercise of its high intellectual powers, is daily brightening. The means in operation for waking up and perpetuating a taste for intellectual improvement, were never so great as at the present day. 'The fountains of the great deep have been broken up ; and a deluge of information—theological, scientific, and civil—is carrying all before it, filling up the vallies, and scaling the mountain tops. A spirit of enquiry has gone forth, and sits brooding upon the mind of man. As to the effect, much will depend upon right regulation and direction.'

No sound objection can be brought against the universal spread of knowledge. We were made to be reasonable beings : and 'how can we reason but from what we know ?' The world has reasoned superficially, comparatively speaking, long enough. Give the great mass of the people facts—the more the better ; and let them reason from them ; and then we may look for an extensively enlightened public sentiment on all important subjects. Until this be done, the ten thousand divisions of the world must continue to exist : for doctors must disagree while the mass of the people remain in ignorance—because the intellect of the whole world is needed to decide many of the important questions which are, and ever have been agitated in the world.

It is the duty of every one, then, who perceives the great advantages of universal education, to do all in his power to dissipate the clouds of ignorance which still hang over our globe, in order to hasten the period when the sun of knowledge shall gleam upon the world in all its meridian splendor. L.

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From Prof. Babbage's Work on Economy of Machinery, &c.

## CONVENIENT METHOD OF GUAGING.

The time and labor consumed in guaging casks partly filled, has led to an improvement which, by the simplest means, obviates a considerable inconvenience, and enables any person to read off, on a scale, the number of gallons contained in any vessel as readily as he does the degrees of heat indicated by his thermometer. A small stop-cock is inserted near the bottom of the cask, which it connects with a glass tube of narrow bore fixed to a scale on the side of the cask, and rising a little above its top. The plug of the cock must be turned into three positions : in the first it cuts off all communication with the cask ; in the second, it opens a communica-

tion between the cask and the glass tube : and in the third, it cuts off the connexion between the cask and the tube, and opens a communication between the tube and any vessel held beneath the cork to receive its contents. The scale of the tube is graduated by opening the communication between the cask and the tube, and pouring into the cask a gallon of water. A line is then drawn on the scale opposite the place in the tube to which the water rises. The operation is repeated, and at each successive gallon a new line is drawn. Thus the scale being formed by actual measurement, both the proprietor and the excise officer see, on inspection, the contents of each cask, and the tedious process of guaging is altogether dispensed with. Other advantages accrue from this simple contrivance, in the great economy of time which it introduces, in making mixtures of different spirits, in taking stock, and in receiving spirits from the distiller.

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## INVENTION AND DISCOVERY.

The object of the former is to produce something which had no existence before ; that of the latter, to bring to light that which did exist, but which was concealed from common observation. Thus we say, Otto Guericke invented the air-pump ; Sanetorius invented the thermometer ; Newton and Gregory invented the reflective telescope ; Galileo discovered the solar spots ; and Harvey discovered the circulation of the blood. It appears, therefore, that improvements in the arts are properly called inventions, and the facts brought to light, by means of observation, are properly called discoveries.

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## TIME.

It may be thought, that a considerable portion of the community *want time* to attend to the cultivation of their minds. But it is only necessary to make the experiment, to find *two things;* one, how much useful knowledge can be acquired in a very little time; and the other, how much time can be spared, by good management out of the busiest day. Generally speaking, our duties leave us time enough, if our passions would but spare us ; our labors are much less urgent in their calls upon us, than our indolence and our pleasures. There are very few pursuits in life, whose duties are so incessant, that they do not leave a little time every day to a man, whose temperate and regular habits allow him the comfort of a clear head and a cheerful temper, in the intervals of occupation; and then there is one day in seven which is redeemed to us, by our blessed religion, from the calls of life, and affords us all time enough for the improvement of our rational and immortal natures. —*Everett's Address.*

## QUESTION.

Three men were employed to draw a load of plaster from Boston to Windsor, for \$26,45, each man having one horse. A and B's horses are supposed to do 3-4 of the work, A and C's 9-10, and B and C's 13-20. They are to be paid proportionally. What is each man's share of the money ?

B.

## ANSWER.

If the proposer means to be understood that A and B are to receive 3-4 of the \$26,45, and A and C 9-10, and B and C 13-20, it is no wonder that the two schoolmasters were unable to solve so absurd a problem. But if he means that the sum of A & B's shares, shall be to the sum of A and C's as 3-4 to 9-10, and to B and C's as 3-4 to 13-20, (which I infer he does mean by the expression 'they are to be paid proportionally,') then I see not the least difficulty in the solution.

Let $x:y::$ A's share : B's share, and $y:z::$ B's share to C's.

Likewise let $x+y=3\text{-}4$

Then $x+z=9\text{-}10.$

And $y+z=13\text{-}20.$

Then $$\frac{(2\,x+y+z)-(y+z)}{2}=x=1\text{-}2$$

And $$\frac{(2\,y+x+z)-(x+z)}{2}=y=1\text{-}4$$

And $$\frac{(2\,z+x+y)-(x+y)}{2}=z=2\text{-}5$$

Then $x+y+z=23\text{-}20$

Then 23-20 : 26,45 : : 1-2 : 11,50=A's share.
23-20 : 26,45 : : 1-4 : 5,75=B's share.
23-20 : 26,45 : : 2-5 : 9,20=C's share.

\$26,45=Total.

If 'A Subscriber' will inform us by what process he gets 'one mill and a fraction too much,' he will perhaps throw additional light on the 'singularity' of this *very abstruse* question !

NO SCHOOLMASTER.

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## QUESTION.

The fore wheel of a carriage makes six revolutions more than the hind wheel, in going 120 yards; but if the periphery of each wheel be increased one yard, it will make only four revolutions more than the hind wheel in the same space. Required the circumference of each wheel.

# THE

# YOUNG MECHANIC.

## FEBRUARY, 1833.

For the Young Mechanic.

### ON SPECIFIC GRAVITIES.

The question is often asked, What is the meaning of specific gravity ? Men of scientific turn, but without much system in regard to any science, find it difficult to comprehend the difference between *common weight* and specific weight.

The subject is an important one, and ought to be well understood by every mechanic as well as professional man. It will be my aim, in this essay, to give a concise view of this important subject, in a manner, I hope, intelligible to all readers.

Specific gravity is a term continually made use of in physical science. It is used to express the weight of any particular kind of matter, compared with the weight of the same bulk of some other matter, which is supposed to be well known and easily accessible. This latter is considered as unity, or 1, 100, or 1000, as may be found necessary. This is called the standard, or that to which the weight of all substances must be referred. The substance generally used for this standard is pure water.

The weights of bodies, in a philosophical sense, are considered as measures of the number of material atoms, or the quantity of matter which they contain. This is, on the supposition that every *atom* of matter is of the same weight, whatever may be its variable form. Reference is had to specific gravity for ascertaining the weight of an atom in various ways, which I shall hereafter illustrate.

Notwithstanding the changes which heat and cold cause in the bulk of bodies, and the permanent varieties of the same kind of

matter, caused by a variety of circumstances, of growth, texture, &c. most kinds of matter have a certain constancy in the density of their particles, and therefore in the weight of their bulk. Thus the purity of gold, and its degree of adulteration, may be inferred from its weight, it being purer in proportion as it is more dense. The density of different kinds of tangible matter, becomes characteristic of the kind, and a test of its purity ; it denotes a particular appearance in which matter exists, hence termed *specific*.

But this density cannot be directly observed. It is not by comparing the distance between the atoms of matter in gold and in water, that we say the former is nineteen times denser than the latter, and an inch of gold contains nineteen times as many atoms as an inch of water ; we calculate on the equal gravitation of every particle of matter, whether of gold or water ; therefore the weight of any body becomes the indication of its material density, and the weight of a given bulk becomes *specific* of that kind of matter, ascertaining its kind and purity in their form.

In order to make this comparison of general use, it is evident that the standard must be familiarly known, must be uniform in its density, and the comparison of bulk and density must be easy and accurate. The most obvious method would be to form accurately a piece of the standard matter, of some convenient bulk, and to weigh it exactly, and rate its weight ; then to make the comparison of any other substance, it must be made into a mass of the same precise bulk, and weighed with equal care. The most convenient way of expressing the specific gravity, would be to consider the weight of the standard as unity, and then the number expressing the specific gravity is the number of times that the weight of the standard is contained in that of the other substances. This comparison is best made in fluids. We may make a vessel of known dimensions equal to that of the standard which we employ, weigh it when empty, and then when filled with the fluid. But a better way is, to use some fluid as a standard. Any vessel may then be substituted, and we may attain to very great accuracy, by using a viol with a slender neck, such as a small mattrass ; for when this is filled to a certain mark in the neck, any error in the estimation by the eye will bear a very small proportion to the whole. The weight of the standard fluid, which fills it to this mark, being carefully ascertained, is noted. The specific gravity of any other fluid is obtained by weighing the contents of this vessel when filled with it, and dividing the weight by the weight of the standard ; the quotient is the specific gravity of the fluid. But in all other cases, this is a very difficult problem. It requires very nice manipulations, and a very accurate eye, to make two bodies of the same bulk. It has been calculated that an error of 1-100 of an inch, in the linear dimensions of a solid body, makes an error of 1-30 in its bulk ; and bodies of irregular shapes, and friable texture, cannot be brought into suitable dimensions for measurement.

These inconveniences and difficulties were relieved by Archimedes, who, from the principles of hydrostatics, deduced the accurate method which is now universally practiced for discovering the specific gravity and density of bodies. Instead of measuring the bulk of the body by that of the displaced fluid, we have only to observe the loss of weight sustained by the solid. This can be done very accurately. Whatever may be the bulk of the body, this loss of weight is the weight of an equal bulk of the fluid, and we obtain the specific gravity of the body, by simply dividing its whole weight by the weight lost; the quotient is the specific gravity, when this fluid is taken for the standard, even though we should not know the absolute weight of any given bulk of this standard. We obtain, likewise, an easy and accurate method of ascertaining this fundamental point. We have only to form any solid body into an exact cube, sphere, or prism, of known dimensions, and observe what weight it loses when immersed in this standard fluid. This is the weight of the same bulk of the standard to be noted; and thus we obtain an accurate method for measuring the bulk or solid contents of any body, however irregular be its shape. We have only to determine how much weight it loses in the standard fluid; we can compute what quantity of the standard fluid will have this weight. Thus, if we should find that a quantity of sand loses two hundred and fifty ounces, when immersed in water, we learn from this that the solid measure of every grain of the sand, when added into one sum, is equal to the fourth part of a cubic foot, or to four hundred and thirty-two cubic inches.

The immediate standard, pure water, is, of all the substances with which we are acquainted, the best for an universal standard of reference. In its ordinary natural state, (viz. rain water,) it is sufficiently constant and uniform in its weight for every examination, where the utmost mathematical accuracy is not wanted. All its variations arise from impurities, from which it may be separated by distillation. When pure, its density is invariably at the same temperature.

Water is therefore universally adopted for the unit of that scale on which we measure the specific gravity of bodies, and its weight is termed 1. The specific gravity of any other body, is the real weight in pounds, or ounces, when of the bulk of one pound, or one ounce of water. It is, therefore, of the utmost importance, in all matters relating to the specific gravity of bodies, to have the precise weight of some known bulk of pure water.

In a future number, I shall make some further remarks on this important, but too much neglected subject.

J. R. C.

Quincy, Jan. 8.

## GEOMETRY AND ARITHMETIC.

[Continued from page 15.]

### PARALLELOGRAM.

A parallelogram is a four-sided figure, whose 'opposite sides are equal in length, and parallel or at equal distances from each other.

There are four kinds of parallelograms, viz. the square, rectangle or oblong, rhombus, and the rhomboid.

To find the area or quantity of surface in any variety of parallelogram. The length is to be multiplied by the perpendicular* breadth, and the product will be the area in square inches, feet, yards, &c. according as the dimensions are taken in inches, feet, yards, &c.

Fig. 1.

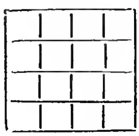
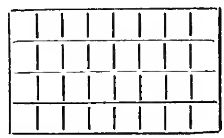


Fig. 2.



*Example* 1. If the side of a square be four inches, its area will be four times four, or sixteen square inches. This may be seen by inspecting figure 1, each side being divided into four parts, and lines drawn across the square from each division, divides it into sixteen small squares, which in this case are square inches.

*Example* 2. If the length of an oblong be eight feet, and the breadth four feet, its area will be thirty-two square feet. See figure 2.

It has been stated, (page 14) that if a circular vessel be put out of its regular shape, its area would be less. The same is true of the square. Mechanics know the difficulty of keeping their work square; hence it is a common practice for carpenters to brace their frames for doors and windows by a diagonal stay, which is

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**Perpendicular line.* When a straight line meets another, so as to make the two adjacent angles equal, the lines are said to be perpendicular to each other.

The two parts of a correct carpenter's square are always perpendicular to each other, and it matters not how it is placed, whether on the bench or against the wall.

Suppose a straight stick to have a base, so that when placed on the floor of a room, it has no tendency to lean one way more than another—we say the stick is perpendicular to the floor; but if it is placed against a side wall, it will be perpendicular to that; and if placed on the slant roof of a house, it is then perpendicular to that part of the roof. The direction of a plumb line tends to the center of the earth, and is called a vertical line—it is also perpendicular to a level plane, such as that formed by still water.

not removed until the frame is secured in the wall of the building. Such a stay is represented by the line drawn across from opposite

Fig. 3.

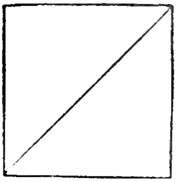


Fig. 4.

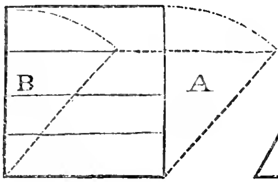
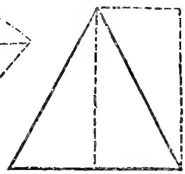



Fig. 5.



angles of figure 3. A good method of proving such work, is, to measure across from opposite angles both ways, and if they are of the same length, the work is square.

Figure 4 is a square. If we suppose it furnished with a joint or hinge at each angle, so as to be easily put out of the square form, it might be used to show the reason for taking the perpendicular breadth in measuring such figures. Let us suppose the lower side of the square to remain still, while the upper part is moved to the right, it will then assume the form of a *rhombus*, which is represented by the lower line of the square, and three dotted lines. The area of this figure is less than that of the square, for its perpendicular breadth is only equal to three-fourths of the breadth of the square. A part of the rhombus A, in a triangular form, projects beyond the square; if this was removed within the square, it would fill up the vacancy B. There would then be one-fourth of the square remaining at top, showing the difference between the areas of the two figures, that of the rhombus being only three fourths of the square, although its sides are of the same length.

If an oblong or rectangle, were put out of its regular shape, it would then form a *rhomboid*. It is evident that the only true way of finding the areas of these figures, is to multiply the length by the perpendicular breadth, for if we measured the slant breadth, the areas of the rhombus and rhomboid would appear to be the same as the square and oblong, which is evidently wrong.

The above examples, although simple, are very important, as the key to the measurement of all other figures. We can apply them to the triangle, and all the polygons, whether regular or irregular, they being made up of triangles; in fact, the circle is measured as a polygon of an infinite number of sides.

### TRIANGLE.

The simplest geometrical figure, terminated by three straight lines, is called a triangle.

To find the area of a triangle. Take one side for the basis, and multiply it by half the perpendicular height; or half the basis multiplied by the whole height will give the area.

*Example.* Figure 5 is a triangle, with all its sides equal. A perpendicular, let fall from its upper angle, divides the base line into two equal parts. It is plain to the eye, that this triangle is equal in area to the oblong, whose breadth is equal to half the basis of the triangle, and length equal to the perpendicular height of the same. If this triangle was cut into two equal parts, they might be so placed as to form the oblong, in the same manner that figure 3 is formed by two triangles. In fact, the area of any triangle, is half of the area of a parallelogram, upon the same basis, and of the same height.

APPLICATIONS.

Any person who is well acquainted with the mensuration of a few simple figures, may with a little practice survey lumber, and the various kinds of artificers' work, such as painting, flooring, paving, &c. where the surface only is taken into consideration. Land surveying is conducted on the same principles. This subject is receiving much more attention in our schools than formerly, by the aid of books written in a more familiar style, and by the use of Mr. Holbrook's geometrical apparatus, children can learn in less time, and by seeing the real form of the object, the impression is more correct and also more lasting, than it would be from seeing a mere picture. PHILO.

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## CHEMISTRY.

[Continued from page 11.]

### ATTRACTION.

Of the ultimate constitution of matter we know nothing. The hypothesis of Newton, that it is composed of hard indivisible particles, inconceivably minute, is well adapted to convey distinct notions of chemical phenomena ; and it is, moreover, though incapable of being proved, universally admitted. The particles of matter have been divided into two kinds, *Integrant* and *Elementary;* the former are those into which a compound body can be divided, without being decomposed ; the latter, those particles which are simple and incapable of division. For example—the atoms of marble are integrant, each consisting of carbonic acid and lime. If we decompose an atom of marble, we obtain carbon, oxygen, and calcium, all of which being incapable of further division, are called simple substances, and their ultimate particles elementary.

All matter is under the influence of a power, the tendency of which is to draw one portion to another. It acts both on the mass and on the minute parts of which bodies are composed. To this power the term ATTRACTION is applied. We shall first consider its action upon masses of matter, next upon integrant, and lastly upon elementary particles. It is a question among philosophers whether the operation upon these different states of bodies be referable

to one general cause, modified by circumstances, or whether there be an attraction, which acts only on masses of matter, and another on its particles. Modern philosophers are disposed to adopt the former opinion, and consider the attractions which exists between bodies as depending upon one and the same cause ; the different effects produced, however, have given rise to the divisions before mentioned, and, for the sake of perspicuity, they have been considered as different kinds of attraction.

The power by which bodies tend toward the earth, by which the bodies of the planetary system are regulated in their movements, and retained in their orbits, is called the attraction of gravitation, and extends to all matter at all distances. Were it not for this power, a stone thrown into the air would not fall to the earth, but continue its motion, in a straight line, unless stopped by the resistance of some body which it might encounter, or medium through which it passed. The force of the attraction of gravitation, is directly as the quantity of matter, and inversely as the square of the distance ; the quantity of matter being in different cases as 1, 2, 3, 4, the attracting force, at a given distance, will be as those numbers directly ; but if those numbers represent distances at which the body is successively placed, the attracting force will be 1-4th, or 1-9th, or 1-16th as great as it was at the distance 1.

Beside gravitation, there are other attractions which act upon the mass at sensible distances, viz. magnetic and electric attraction—the former illustrated by a loadstone drawing to it a piece of iron ; the latter by rubbing a stick of sealing-wax, or a glass rod, and holding it near small pieces of paper.

The attraction which acts between the particles of matter, at insensible distances, is termed *contiguous* attraction, in contradistinction to that before mentioned, which is termed *remote*. When simple or compound particles of the same kind are united, they are said to be held together by the attraction of *cohesion*, or aggregation. Thus the particles of *marble*, in a mass of marble, are united by cohesion, but the carbonic acid and lime of which the marble is composed, are united by chemical attraction. To show an example of the attraction of aggregation, place two globules of quicksilver on a smooth surface, and make them approach each other until they touch, when they will immediately unite and form one.

Cohesive attraction exerts different forces on different bodies, and on the same bodies under different circumstances. It is stronger in solids than in fluids. That it acts upon the latter is evident from the globular form which a drop of any liquid assumes ; but with aeriform fluids this power is entirely overcome ; their particles repel each other.

The form assumed by solids, as a result of cohesive attraction, depends upon the circumstances under which its influence takes place, sometimes an irregular mass being produced, at others regular figures called crystals.

Crystallization may be effected by dissolving the substance in a fluid, and separating a portion of the fluid by heat, or by melting the substance, and suffering it to cool slowly. The first method of producing crystals is by far the most common, and the fluid most used is water. Most substances, when separating from their solvent, carry with them a portion, and as the solvent most common is water, it is called *water of crystallization,* and upon this their hardness, transparency, and brilliancy often depends. The quantity of water which crystals contain, differs with different substances. The crystals of carbonate of soda contain about two thirds their weight of water; the well known medicine Glauber's salt, contains about one half, and sulphate of lime about one-fifth its weight of the same liquid. Some crystals part with their water by exposure to the air; they are then said to *effloresce.* Others attract water from the atmosphere, and are said to *deliquesce.* Crystals which have but little water, when exposed to heat, (common salt, for example,) break with a crackling noise, undergoing what is termed *decrepitation;* those, on the other hand, which contain much water of crystallization, such as Glauber's salt, or nitrate of ammonia, when exposed to heat, liquify, by dissolving in their water, and are said to undergo *watery fusion.*

The forms which crystals assume are various, but each substance has a form peculiar to itself, and within a certain limit, this seldom varies; thus common salt crystallizes in cubes—Glauber's salt in oblique rhombic prisms—alum forms octahedral crystals. A considerable variety of forms occur in the same body, but in these cases, each contains one appropriate figure, from which all the diversities have sprung. Our limits will not permit us to enter further into this field of interesting enquiry. We must refer the reader, therefore, to the works on crystallography, and proceed to the investigation of CHEMICAL AFFINITY, a knowledge of which will be found of practical utility to every mechanic—to all of every profession.

Chemical attraction differs from all others in the results produced. Like cohesive attraction it acts only at insensible distances, but differs from this by uniting dissimilar substances, and producing a compound differing from either of its ingredients; thus, oil of vitriol and potash, either of which, if taken internally, would produce death, if mixed in certain proportions will unite and form a compound which may be taken into the stomach with safety, all its properties being entirely different from those of vitriol or potash.

If we mix together muriatic acid gas, and ammoniacal gas, chemical union will take place, and a solid salt will be the result.

Oil of vitriol, added to a saturated solution of muriate of lime, will also produce a solid, or nearly solid compound.

Crystallized nitrate of ammonia and Glauber's salts, rubbed together in a mortar, will form a liquid.

To a solution of copperas, add an infusion of galls. Both these liquids are nearly colorless, yet a deep black will be formed ; add to this a little muriatic acid, and the black will disappear.

To a little blue vitriol, dissolved in water, add water of ammonia —a beautiful violet color will be produced.

To a solution of prussiate of potash, add a solution of copperas ; a deep blue solid will form, which will fall to the bottom or *precipitate.*

To filings of copper add aquafortis ; a rapid union will take place, and a blue liquid will be formed, which, on cooling, will form blue transparent crystals.

Produce a little nitrate of copper, moisten it with water, and wrap it up in a piece of tin foil tightly ; the action will be so intense as to produce combustion.

Mix a little chlorate of potash with dry sugar, and touch the mixture with a drop of oil of vitriol ; it will burst into flame with great brilliancy.

These are some of the experiments which serve to illustrate chemical affinity and chemical action. The former term, it should be kept in mind, is applied to the power which produces, and the latter to the change that takes place.

Some substances unite together in all proportions ; such, for example, as acids and water, while others unite only in certain proportions ; thus water will dissolve about one third of its weight of common salt, only ; if more be added, it will remain solid. A fluid in this state is said to be *saturated.* But saturation with one substance, does not imply that the fluid is incapable of dissolving another substance. On the contrary, it is sometimes the case that a fluid, saturated by one substance, has its power of dissolving another substance much increased.*

Some substances combine together in only one proportion, while others combine in several definite proportions. When substances combine together in such manner as completely to disguise the properties of each other, the compound is called *neutral.* Common salt will serve as an example, it being composed of a powerful acid and caustic soda, yet possessing different properties from either.

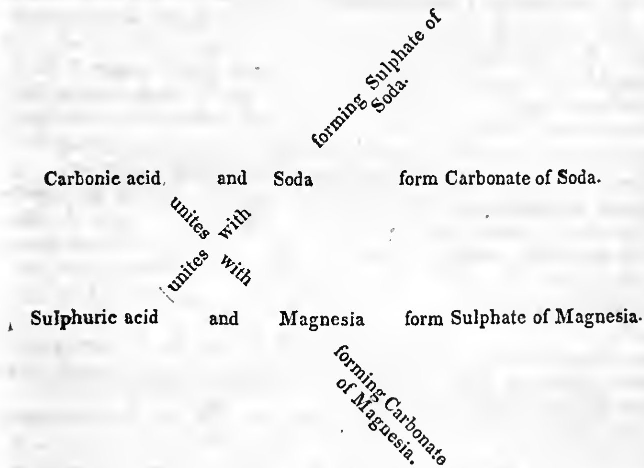
Some bodies, which have no affinity for each other, may be made to unite by the intervention of a third body having an affinity for both ; thus oil and water may be agitated together for any length of time, without effecting a union, but if potash be added, the three substances will unite, and form the well known compound—soap. On the contrary, some bodies when united, may be separated by the addition of a third ; thus, a solution of potash added to

* The combination here spoken of, and others similar, differ from chemical combinations, as the properties of the ingredient are not at all, or but little changed. They differ also from mere mixture, as separation cannot be effected by mechanical means.

*Epsom salts*, (a compound of oil of vitriol and magnesia,) will occasion a separation of the magnesia, by uniting with the oil of vitriol. We say the vitriol has a stronger affinity for potash than it has for magnesia.

If we add carbonate of soda to Epsom salts, instead of potash, two new compounds will be produced; carbonate of soda being a compound of carbonic acid and soda, a double decomposition takes place, the carbonic acid of the carbonate of soda uniting with the magnesia of the Epsom salts, and the acid of the Epsom salts uniting with the soda of the carbonate. To this affinity the terms *double elective* are prefixed, and to the former those of *single elective.*

These cases of double decomposition are best illustrated by a diagram.




For the Young Mechanic.

## LAWS OF MOTION.

REPLY TO J. M. W.

Messrs. Editors,—When perusing the last number of the Young Mechanic, I observed an article entitled 'the evidences of the rotary motion of the earth;' the object of which was, to obtain an explanation of the assertion made by Professor Farrar, 'that a body let fall from some distance above the earth's surface, as from the top of Park-street steeple, would not strike a point directly under it, but would strike the earth west of that point.' This assertion, I think, is perfectly correct. The body, while falling, is act-

ed upon by two forces ; one is the force of gravity, and the other the projectile force given it by the steeple. The last force is constantly diminishing, because the moment that it is set at liberty, the original projectile force is stopped—consequently it moves forward only by its own momentum, which is constantly decreasing, and will finally be overcome by gravity, and strike the earth west of the point directly under that from whence it started.

G. W. M.

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## ESSAYS ON KNOWLEDGE.—No. II.

### DEFINITION, &c.

In my first essay, I recognized the doctrine of the existence of a Creator and Governor of the Universe, which I consider established. But this, together with many other propositions which I may assume as correct, without entering into a discussion of them, may be illustrated in the course of the series. I shall bear in mind the department in which I am writing, and endeavor, in all cases, to keep within the sphere of simple philosophical reasoning.

There are two kinds of knowledge; *intuitive* and *discursive.* Intuitive knowledge is immediate perception of truth ; discursive, that which is obtained by deduction of reason. For example—the knowledge that a whole is greater than a part, is obtained by immediate perception ; while the knowledge that three angles of a triangle are equal to two right angles, is obtained by deduction of reason.

All the knowledge possessed by the Author of the universe is probably intuitive ; all the knowledge man obtains, is acquired by intuition and deduction of reason.

The doctrine of *innate ideas* may be considered as exploded ; though there is not so great a difference in the opinions of the different schools of philosophers on this subject, as some suppose. That sensation and reflection furnish mankind with the first materials of all their knowledge, is not now disputed.

It is said that the mind is the eye of the soul. This is undoubtedly true in some sense ; but I think it will lead to less confusion, as to terms, to assume that both the mind and the soul are comprehended in the term *mind.* I consider the mind as including all of what is called the spiritual part of man. It may therefore be more proper to say, that the faculty of understanding is the eye of the mind. It is also said, that by knowledge the mind perceives truth, as by vision the eye sees light. This is very well, except that, strictly speaking, *understanding* should be substituted for *mind*, in this case.

Some have been led to the conclusion, that a knowledge of everything is necessary, in order to understand any one thing fully.

This is unsound. If the mind could know all truth, it would be as comprehensive as the mind of God. 'As the eye may see corporeal objects, without seeing the nature, the number, the form, or positions of their interior elements, so the mind of man may know things and truths, without knowing all their causes, relations, properties, and effects. The eye may see the ocean, without being able to see its depth or extent; and the mind of man may see God, without being able to know all the perfections of his infinite nature.' One truth after another may be communicated to the mind, in its present state, by intuition and deduction of reason, as perfectly as if it were in possession of all other truths. Every thing above human comprehension, may properly be termed *mystery*.

L.

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## PATENTS FOR MASSACHUSETTS,

### GRANTED IN MAY, 1832.

From the Journal of the Franklin Institute.

For *Fastenings for Bedsteads, Sofas, &c.* John P. Allen, Manchester, Essex county, Massachusetts.

The nature and antiquity of this invention, will be rendered apparent by the claim, which is to 'the application of the right and left hand iron screw to bedsteads, sofas, and couches, for the purpose of fastening together into solid frame work.' We have neither time nor inclination to ascertain how many patents have been issued for putting beadsteads together by right and left handed screws, but recollect several; in some of them it is proposed to make the screws of wood, and in others of brass. Whether or not *iron* has been mentioned, we cannot say; and, if not, the present patentee has the 'forlorn hope' of sustaining his claim, by a strong material, it is true, though not by any thing which he has *invented* or *discovered;* he having merely substituted one well known material for another, which attains the same end, and by the same means.

For a *Washing Machine*, called the double cylinder washing machine; John S. Pulsifer and Ebenezer Pulsifer, Ipswich, Essex county, Massachusetts, May 21.

This machine is so truly a counterpart of that patented by Mr. Simon Savage, on the 11th of April last, and described p. 236, that we shall merely refer the reader to the account there given, for a full display of the present invention.

For a *Stereotype Block;* Bradbury Hackett, Boston, Massachusetts, May 21.

For an improved *Printing Press*, denominated the 'Faustus Printing Press;' Seth Adams, Boston, Massachusetts, May 23,

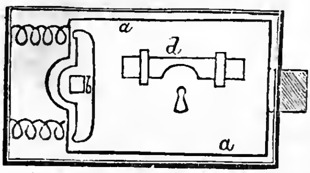
We shall not attempt to describe the manner of arranging the various parts of this press. The patentee claims 'the combination of the crank, the cam, and other parts together, so as to move the platen, or frisket, and produce the effects described. The press is to be operated upon by hand, a handle being attached to a fly-wheel for that purpose, as in several other presses.

For an improvement in the *Apparatus for Baking or Roasting*, usually called the reflecting tin baker ; William Prescott, Boston, Massachusetts, May 24.

This is confessedly the common tin kitchen, but an improvement in it is claimed, which consists in placing the pan or trough, which collects the gravy, close to the front, and allowing the lower part of the kitchen to slope forward, so as to carry all which falls upon it into the trough. This constitutes the invention, and forms the subject of the claim.

For a *Metallic Stereotype Block;* Samuel Sawyer, Boston, Massachusetts, May 29.

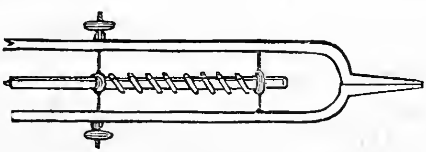
For *Spring Catches or Locks for Doors;* Robert J. Byram, Boston, Massachusetts, May 31.




We cannot give the precise structure of this lock, without a more lengthened description than we can allot to it. One of its principal features, however, is the making the bolt in such a way that it forms a frame, the rim of which slides against the sides of the box of the lock, as seen at *a a*. The tumbler *b*, standing in the center of this, draws the bolt back, which is forced forward by the spiral springs. A small bolt, *d*, shooting against the frame, may serve to lock the door. The patent is taken for these and certain other particular arrangements.

## CENTRE POINT SPRING BIT.

Patented by Daniel Flint, Nobleborough, Maine, April 19, 1832.



This bit may be likened, in form, to a tuning fork, the handle of which would represent the shank, and the forked ends the cutting points. One of these points is notched, so as to cut a double groove, and the opposite point is chisel shaped, to cut out the stuff between the two grooves. The bit may be fixed in a lathe, or stock. To guage it to the exact size required, a thumb screw

passes through the two forks, and by means of this the points may be drawn together. The inside edges of the cutting ends may be so formed as to give a taper or beviled entering to the plug which is to be cut out by it. There is also a centre piece, which, being borne up by a spiral spring, recedes as the points advance.

The principal intention of the bit is to manufacture plugs for ships, although it is applicable to other purposes, such as making bungs for barrels, &c.

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## Miscellany.

*Durability of Watches.*—The durability of common watches, when well made, is very considerable. One was produced, in '*going order*,' before a committee of the House of Commons, to inquire into the watch trade, which was made in the year 1660; and there are many of ancient date in the possession of the clock-makers' Company, which are actually kept going. The number of watches manufactured for home consumption, was, in the year 1798, about 50,000 annually. If this supply was for Great Britain only, it was consumed by about ten and a half millions of persons.

*Improvement.*—Mr. E. Palmer, of Buffalo, N. Y. has invented a new method of making nails for shoeing horses and oxen, for which he has obtained a patent. It is an invention which promises to be of great value to the community and to the inventor, who is at present the principal proprietor. Some idea may be formed of its importance, from the fact that one man can manufacture nails in this way, at least as fast as fifty men can in the usual way.

*Ship Caulking.*—It is stated in the French Journals, that an important discovery has been made with regard to the caulking of vessels; viz. that by mixing the essence of tobacco with the pitch and tar, the attack of worms and destructive insects is prevented, and the coppering of ships' bottoms rendered unnecessary.

*To give Busts the appearance of Marble.*—A curious process is communicated in a French scientific journal for giving to busts and statues in plaster the appearance of marble. Dissolve alum in water to a strong solution by means of heat. The bust is then thoroughly dried, and in that state plunged into the liquid solution, where it is left from fifteen to thirty minutes; then it is suspended over the liquid till it ceases to drop. When it is cool, apply more of the solution to it by means of a sponge, and continue the opera-

tion until the alum forms a chrystalline coat on the surface. When it is perfectly dry, polish it with sand paper, and finish by polishing it with linen, slightly moistened in pure water. Use a tub of wood heated by means of a boiler of water for the solution in preference to metallic substances, which will discolor it more or less.'

*Gas Lights.*—A committee of the Philadelphia City Council has reported in favor of lighting the city with gas, and that the City Solicitor concurs with them in opinion that they 'may draw upon the Gerard estate for the amount required, of course regarding the will of the testator with regard to primary objects, viz. the College and the City police. They calculate that the saving will be 33 1-3 per cent. over the use of oil. The whole expense is estimated at $687,064. The cost of the works will be $200,000—of 552,873 feet of pipe and laying, 424,564,71. In Baltimore, the gas company furnish 3000 private and 100 public lamps. They have incurred great expense in the erection of two setts of works, the first being a failure. They do not limit the quantity of gas to time, yet their stock is 35 per cent. above par, and pays 8 per cent. dividend. In New-York, the gas company lights 10,000 private and 376 public lamps, and though they lose annually as a bonus to the city, 4 or $5000, in furnishing the city lamps, their stock is 40 per cent. above par, pays 10 per cent. premium, and a surplus is annually kept in reserve.

In Boston the works are private property.

The committee believe that, at the rates above given, the use of gas will save 33 1-3 per cent. upon the present expenditure, and as the profit of manufacturing is considerable, they believe that nearly the whole tax for lights will be saved, by the amount of private burners supplied.

*Law Suit.*—A suit, by Dr. Nott against a person for infringing his patents for coal stoves, was lately tried in the U. S. Court for the Northern District of New-York. An effort was made on the part of the defendant to show that the principles of the improvement were not new, and the patents consequently void. The case was summed up to the Judiciary by the Doctor himself, and the Jury rendered a verdict of $850 damages, which, according to the statute, are to be trebled. From the testimony adduced on the trial, it appears that the Doctor has not 'rested from his labors,' but is still proceeding with his experiments on this subject. From the success which has attended him thus far, we have reason to hope for still further improvements from his researches.

## ANSWER.

MESSRS. EDITORS—In answer to the question in your last respecting the wheels of the carriage, I would say, the circumference of the greater is five yards, and the less four yards.

My solution is as follows:

Let $x$=circumference of fore wheel,

" $y$= do. " hind "

Then by the question, 1 $\quad \frac{120}{x}=\frac{120}{y}+6$

2 $\quad \frac{120}{x+1}=\frac{120}{y+1}+4$

Clearing of fractions, And uniting terms,
3 $\quad 120\,y=120\,x+6\,x\,y$
4 $\quad 116\,y=124\,x+4\,x\,y+4$

By transposition and Separating factors,
5 $\quad x\,(120+6\,y)=120\,y$
6 $\quad x\,(124+4\,y)=116\,y-4$

And
7 $\quad x=\frac{120\,y}{120+6\,y}$
8 $\quad x=\frac{116\,y-4}{124+4\,y}$

Then by proportion, $116\,y-4 : 124+4\,y :: 120\,y : 120+6\,y$

By multiplication of extremes and means, $696\,y^2-480-24\,y+13920\,y=14880\,y+480\,y^2$

By uniting terms, $216\,y^2-984\,y=480$

Dividing by 216, we have, $y^2-\frac{984\,y}{216}=\frac{480}{216}$

By completing the square, $y^2-\frac{984\,y}{216}+\frac{242064}{46656}=\frac{480}{216}+\frac{242064}{46656}$

By extracting the root of both sides And transposition, we have, $y=\frac{492+588}{216}$

Consequently, $y=5$

By putting the value of $y$ in 3d equation, we have $600=120\,x+30\,x$

And $x=4$

E. G.

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## QUESTION.

There are two cubical pieces of composition, valued at \$136 2-3, each of which cost as many (1-6 dollars) per solid inch, as there are inches in a side of the other, and the greater stands on a larger base than the less by nine square inches. Required the side and price of each?

THE

# YOUNG MECHANIC.

MARCH, 1833.

## CHEMISTRY.

[Continued from page 30.]

### ATTRACTION.

There are several causes which operate to prevent or retard chemical action, such as cohesion, elasticity, quantity. First, *cohesion:* In some cases the energy of chemical affinity is so great as to overcome cohesion, while in others it is necessary that this power be first partially overcome. This is accomplished by mechanical division, by solution, or by heat. If two solid bodies, disposed to unite, be brought in contact with each other, the particles which touch will combine, and if the new compound which is formed be liquid at the temperature of the experiment, the combination will continue to take place, but if solid, the process will go no further.

Second, *elasticity*. This power sometimes opposes chemical union, as in the case of the gases, oxygen and hydrogen, which may be retained in mixture for any length of time without uniting; but flame or pressure will cause them to unite with great violence.

Third, the *quantity of matter*. It is found that the quantity of matter has considerable influence on chemical action. If, for example, we wish to saturate water with salts, we shall find that the first proportion added to the water is much more readily dissolved than the latter. Again, if we would decompose saltpetre by sulphuric acid, and use for this purpose sulphuric acid in quantity just sufficient to combine with the base of the saltpetre, we shall find, however carefully our experiment may be performed, that there will remain a portion of the saltpetre, which has escaped de-

composition. This is to be attributed, however, it is most probable, to mechanical obstruction.

*In all chemical combinations, the proportions in which the particles unite, whether simple or compound, are governed by fixed laws.*

This hypothesis, first suggested by Mr. Higgins, has been established by Mr. Dalton's experimental researches, and acknowledged by Davy, Wollaston, Berzelius, and other celebrated philosophers. Marble, from whatever part of the globe it may be obtained, either from its native bed, or prepared artificially, always contains 45 parts of carbonic acid, and 55 parts of lime, in 100 parts. Saltpetre, whether we prepare it by the direct union of its ingredients, or obtain it from its native locality, will consist of 54 parts of nitric acid, and 46 parts of potash. Water, from whatever source obtained, subjected to analysis, always affords 2 volumes of hydrogen to 1 volume of oxygen.

*The combining power of bodies may be expressed by numbers.* In water, for example, the weight of oxygen is to the hydrogen as 8 to 1; if therefore, we express the combining weight of hydrogen by 1, that of oxygen will be 8, carbon 6, sulphur 16, &c. Oxygen and hydrogen have both been assumed as unity by different writers—a circumstance to be regretted, and whatever advantages may arise from the adoption of one over the other, it is certain that either would have been better if universally adopted, than both. In the articles on chemistry which may follow, I shall consider hydrogen as unity.

*If two substances unite in more than one proportion, the lowest compound will contain one or both principles in their smallest combining proportion; and in the higher the proportions will be such as are produced by multiplying the lower by some whole number.*

This will be better understood by an example. Oxygen and hydrogen unite together in the proportions of hydrogen 1 and oxygen 8, to produce water—of hydrogen 1 and oxygen twice eight, or 16, to produce deutoxide of hydrogen. Nitrogen and oxygen unite together in five proportions, thus 1 nitrogen to 1 oxygen, 1 nitrogen to 2 oxygen, &c. &c.

| | | | | | | |
|---|---|---|---|---|---|---|
| Nitrogen | 14, | Oxygen | 8, | form | Nitrous Oxide. |
| do. | 14, | do. | 16, | do. | Nitric Oxide. |
| do. | 14, | do. | 24, | do. | Hypo-nitrous Acid. |
| do. | 14, | do. | 32, | do. | Nitrous Acid. |
| do. | 14, | do. | 40, | do. | Nitric Acid. |

The number representing any compound body, is found by adding the numbers representing its parts. For example, the number representing nitrogen is 14. It combines with oxygen in the proportion of 1 to 1, to form nitrous oxide. This, therefore, will be represented by 14 + 8 or 22. Nitric oxide by 30, &c.

*The respective quantity of any bases, required to saturate a given quantity of any acid, or of any acid required to saturate a given*

*base, are always in the same ratio to each other, to whatever acid or base they may be applied.*

The following will serve as illustration : Sulphate of potash and nitrate of baryta decompose each other, and the proportion of sulphuric acid in the former, will saturate the baryta of the latter ; and the nitric acid of the latter will be saturated by the potassa of the former. This will be better understood by attaching the numbers representing combining proportions.

*Before Decomposition.*

Sulphuric Acid 40 + Potassa 48, forms Sulphate of Potassa.
Nitric Acid 54 + Baryta 78, forms Nitrate of Baryta.

*After Decomposition.*

Sulphuric Acid 40 + Baryta 78, forms Sulphate of Baryta.
Nitric Acid, 54 + Potassa 48, forms Nitrate of Potassa.

The combining weights of bodies, both simple and compound, may be registered in a table ; this has been done by Dr. Wollaston, in his scale of chemical equivalents, the numbers of which, being attached to a sliding scale, afford the chemist great facility in his calculations. By mere inspection of this scale, we learn the equivalent number of any compound or simple body—the proportions of the elements of compounds, and the quantity of these which enter into any particular weight of a compound ; the quantity of any substance required to decompose a compound, and the quantity of the products that will be formed.

### ATOMIC THEORY.

The numbers representing the combining weight of bodies, have been applied to the atoms of which matter is inferred to be constituted ; and the terms atomic weight and atomic constitution are often to be met with. Thus it is said bodies combine atom to atom, 1 atom to 2 atoms, &c. and the number expressing the lowest combining proportion is used to express the weight of the atoms ; but as we cannot be certain that we know the smallest combining quantities of bodies, we cannot be certain that those numbers will correctly express the atomic weight of bodies ; the hypothesis, however, is highly probable. The doctrine of definite and multiple proportions, it should be remembered, is not dependent upon this hypothesis for support, and cannot be affected either by the establishment of the truth or falsity of the atomic theory.*

It remains only to allude to combination by volume. It has been ascertained that gaseous bodies and bodies in the state of

* For a complete view of the atomic theory, see the writings of Higgins, Dalton, Buzelius—Henry's Chemistry, 10th edition, and Thompson's and Turner's Chemistry.

vapor, unite by volume in the proportions of 1 to 1, 1 to 2, 1 to 3, &c. These combinations coincide accurately with the law before mentioned, for it is evident that double, triple, &c. the volume of a gas, must be double, triple, &c. of its weight.

In the combination of bodies by weight, there is, as has been stated, a multiple relation existing between the different combining proportions of the same principle, but in the combination of aeriform bodies, there is a multiple relation also existing between the different principles which unite to form a compound. Thus nitrogen and oxigen combine together,

*By Weight.*

Nitrogen 14 + Oxygen 8.
Nitrogen 14 + Oxygen 16.
&c.

*By Volume.*

Nitrogen 100 + Oxygen 50.
Nitrogen 100 + Oxygen 100.
&c.

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For the Young Mechanic.

## ARCHITECTURE—No. 1.

Architecture is the art of building all sorts of houses, ships, and fortifications ; and is accordingly divided into three branches, civil, naval, and military. Civil Architecture is of very ancient origin—and it is the purpose of this and the following essays, to notice its early progress and history. *Modern* speculators can decide as correctly about the *origin* of building as those could who lived two thousand years ago. For we are in possession of as many facts, tending to throw light on this enquiry, as were possessed by the ancients ; and we can make as good use of them. From these facts we conclude that Architecture, like many other arts, had its origin in necessity. For man would be compelled by inclemency of weather and severity of climate, to seek for some kind of shelter. Caves, and dens, and hollow trees, and such rude dwellings as nature's hand had fashioned, were doubtless first resorted to. But these proving insufficient, man began to exercise his inventive faculties, to remove the inconveniences with which he saw and felt himself surrounded. It was then man became a builder. And, as security was the only object in view, he would use those means *only* which would attain this end. Internal convenience, and external beauty, were ideas with which he was totally unacquainted.

It would seem that a conical shape would suggest itself to the first builders, as the readiest mode of constructing their primeval

huts, and therefore boughs of trees, placed in the ground and brought to a point at the top, and then interwoven with reeds and covered with clay, formed, doubtless, the first artificial dwellings of the human race.

But there was one material inconvenience about these habitations. The sloping sides rendered it difficult for the occupants to stand upright; and to remedy this evil, the cone was exchanged for the square. Upright posts were placed in the ground, to form the sides of the building; and others were laid across their tops to support the covering or roof. Experience had, doubtless, by this time, taught the builders, that water would run down hill better than in any other direction; and they would naturally make use of their knowledge in constructing the roofs of their square dwellings. And therefore rafters, and tie-beams, and pediments, became indispensable characteristics in this first improvement in the art of building.

Such, we may reasonably suppose, was the rude origin of that art, which, in subsequent times was brought to most sublime perfection; and whose astonishing relics still mark the spots where lived the great and glorious nations of by-gone times.

D. B. H.

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## GEOMETRY AND ARITHMETIC.

[Continued from page 26.]

### POWERS AND PROPORTIONS.

By the power of a quantity, is understood its product by itself a certain number of times. Any number is the root or first power of itself. Thus, the first power of 3 is 3; its second power or square is $3 \times 3$ or 9; its third power or cube is $3 \times 3 \times 3$ or 27, and so on. Hence it is evident, that to obtain any power whatever of a given quantity, it must be multiplied by itself, as many times less 1, as are equal to the number which denotes that power, as may be seen in the following

TABLE OF POWERS.

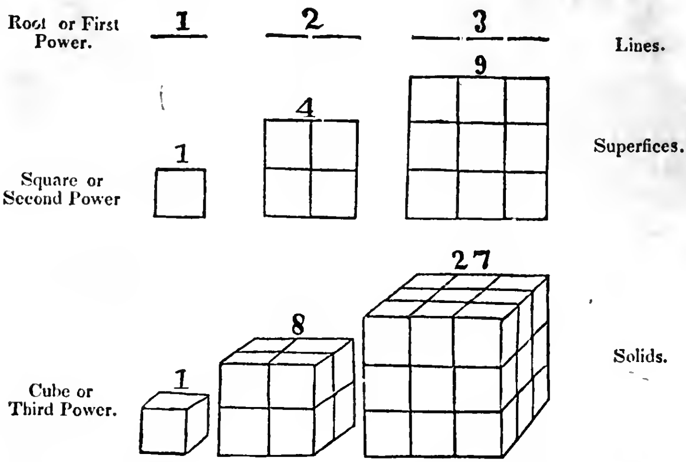
| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| First Powers, | 1. | 2. | 3. | 4. | 5. | 6. | 7. | 8. | 9. | Roots. |
| Second Powers, | 1. | 4. | 9. | 16. | 25. | 36. | 49. | 64. | 81. | Squares. |
| Third Powers, | 1. | 8. | 27. | 64. | 125. | 216. | 343. | 512. | 729. | Cubes. |

It is necessary that we should be able not only to find the required power, when the root is given, but to extract the root when the power is given. In the table above, the third power of 5 is 125; the second power of 8 is 64; the cube root of 729 is 9; and the square root of 49 is 7.

It is not my intention to show how to extract the roots of numbers, as rules for this purpose may be found in most books on arithmetic. My object is to explain the subject generally, and to show

some of its uses, hoping that some of our young friends may be induced to turn their attention to this very useful subject.

The first power is applied to lines; the second power to superfices; and the third power to solids; which may be understood by the following diagrams.




The numbers placed over these diagrams, agree with the first three numbers in the table of powers.

DEFINITIONS.

A line is length without breadth.

A superfice has length and breadth, without thickness.

A solid has length, breadth, and thickness.

If we wish to find the length of a given line, we use a line of some known length as a standard, and this may be an inch, a foot, a yard, &c. The process is only to ascertain how many such lines are contained in the given line.

To find the area or quantity of surface of any superficial figure, we use a surface of some known dimensions for this purpose; and in order to make the process as simple as possible, the square is generally used; the side of this square may be an inch, a foot, a yard, &c. We then proceed to find how many such squares are contained in the given figure.

To find the contents of a solid body, we use a solid of some known dimensions; this is generally a cube, whose side is an inch, a foot, a yard, &c. We then find how many such cubes are contained in the solid body.

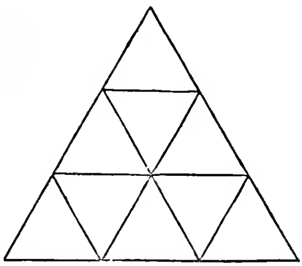
PROPORTIONS.

If lines increase by a common difference, like those in the diagram, they are said to be in arithmetical proportion. Calculations are made on lines by addition or subtraction.

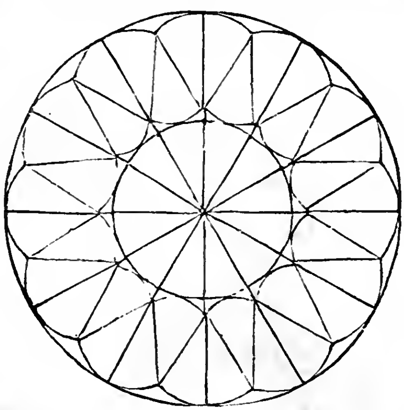
Superfices of the same kind, are to each other as the squares of their similar sides. This may be seen by the diagrams of the square, triangle, and circle. It is also true of all other figures.

Solids of the same kind are to each other as the cubes of their sides. Calculations are made on both surfaces and solids, by multiplication and division, and are said to be in geometrical proportion.

By examining the diagram marked Lines, we find their lengths as 1, 2, 3. The squares whose sides correspond to these lines, are as 1, 4, 9; and the cubes, whose sides are also similar to the above lines, are as 1, 8, 27. We find, in the squares, if the side is doubled, the area is fourfold, and if trebled, the area is increased ninefold, &c. In the cube, if the side is doubled, the solidity will be 8 times as great; and if trebled, 27 times as great, &c.



By examining the diagram of the triangle, we find that one triangle has sides of a certain length; that four such triangles have sides of double the length; and 9 triangles are inclosed by sides of three times the length of the sides of 1 triangle. If we examine



the diagram of the circle, we find 48 triangular figures, called sectors; 12 of them are in the small circle, and 36 between that and the large circle; it may be seen that there is stock enough, if all the small pieces could be brought in, to make 4 circles, each having a diameter equal to half that of the large circle.

### APPLICATIONS.

By the use of the powers of numbers, we are able, from the given lines of surfaces or solids, to find their superficial or solid contents; and by extracting the roots of these powers, we can find the lines of surfaces, or solids, by having their superficial or solid contents given. Thus, if the dimensions of a vessel be given, we determine what it will hold by the first method; or if it be required to make a vessel of a particular shape, to hold a certain quantity, the dimensions are found by the last method.

By knowing the relative proportions of various surfaces and solids, we are able to judge more correctly, and often without the aid of written calculations. If, for example, a town or state is twice as long, and twice as broad as another, it will be four times as large; or if a pond or lake is twice as long, and three times as broad as another, it will be six times as large. Again, if a house is three times the length, breadth, and height of another, it will be 27 times as large; if a cannon ball is twice the diameter of another, it will weigh eight times as much; if a cow is twice the length, and twice the height of her calf, she will be eight times as large; and if a model of a machine is made on a scale of one inch to a foot, the machine will be 1728 times as large as the model; of course, every part must be in due proportion.

Besides the above, there are many applications of these principles to geometry and natural philosophy. Sir Isaac Newton's grand discovery was, that the gravitation of bodies towards each other, is inversely as the squares of their distances, or that it decreases as the squares of their distances increase. The laws of falling bodies operate on this principle, whether it is a block of metal, used for driving piles into the earth, or a stream of water rushing against a water wheel. If a body falls through a certain space, in one second of time, it will fall through four times that space in two seconds, nine times in three seconds, sixteen times in four seconds, and so on, according to the square of the times.

Magnetic, as well as electric attraction, obeys the same law as gravity; and so do light, heat, and sound—viz. their intensities decrease, as the square of the distance increases. PHILO.

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For the Young Mechanic.

## UTILITY OF SCIENCE TO PRACTICAL MECHANICS.

The principal difficulty to be overcome, to make the great body of mechanics, as they should be, habitually studious, is to convince them that it is for their advantage to become *scientific*, as well as practical.

It is the prevailing sentiment, among this large class of the community, that a knowledge of principles is of no use to them; and therefore they take no deep interest in those writings and lectures

which are strictly scientific. The story of that mechanic who said he could get no more than his ten and sixpence a day, even if he did possess a knowledge of science, cannot be too often mentioned. This individual undertook to make a particular machine, and spent considerable time and money in completing it. When it was finished, he found to his utter surprise, that it would not work; and the reason was, an important principle in the science of mechanics, had not been at all regarded. *This* mechanic was now forced to acknowledge that he should have saved a little more than ten and sixpence a day, had he possessed a little more scientific knowledge.

I happened to have in my hand a few days since, the January number of the Young Mechanic. I opened to the engraving designed to illustrate the reflection of light. A friend of mine being present, I showed it to him, and remarked, that here was a fact worth remembering, viz. that a reflected ray of light always made an angle precisely equal to the angle of the incidental one. Instead of assenting to the truth of the observation that this fact *was* worth remembering, my friend replied, 'Of what use is it to you and I to be acquainted with this principle?' I thought it my duty to undertake to show him. Now he happened to be a tinman, and I a mason. And of what possible advantage, (repeated he,) is it to a tinman or a mason, to understand the laws and properties of light? I replied, that it was advantageous to any operative, when applying any principle, to understand what that principle was, so that he might know when it was properly or improperly applied. For it is certainly important for us to know whether we are making a proper or an improper use of a principle. To show that a knowledge of the law of light, stated above, was in some degree useful to the tinman, I alluded to the construction of the patent baker. If the inventor had not known that the angle of reflection was equal to the angle of incidence, he would not have been likely to make the top and bottom of this article diverging towards the fire at the proper inclination. This one instance was sufficient to show that the knowledge of this principle of reflection was of service even to the tinman. And one instance is sufficient to show, that this knowledge is useful to the mason. It is because the angle of reflection is equal to the angle of incidence, that the jambs of modern fire places are flared, instead of being built at right angles with the back. And this flare of the jambs must have that exact inclination which will reflect all the rays of heat which fall upon them from the fire into the room.

Thus I convinced my friend, that it *was* practically advantageous both to him and to me, to remember that the angle of reflection was equal to the angle of incidence.

But even on the supposition that mechanics will not have occasion to apply all or any philosophical principles, yet it is beneficial to have a knowledge of them. It will enable us to judge of the works of others; to detect their faults, to perceive their beauties,

and to know the degree of their utility. With our minds well stored with such knowledge, we shall always find matter for profitable reflection and useful conversation. To be conscious of possessing knowledge, gives to the mind a most pleasureable satisfaction—a real, solid happiness. To this, the operative mechanics are as much entitled as any class of society ; and this we can have, if we will but use the means with which we are amply supplied.

D. B. H.

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For the Young Mechanic.

## EVIDENCES OF THE ROTARY MOTION OF THE EARTH.

Messrs. Editors,—The reply of your correspondent, G. W. M. to my communication, has been to me the cause of considerable thought and reflection on this subject, which has resulted in the belief of the assertion made by Professor Farrar, and the *non*-belief in the position assumed by G. W. M.

I may probably anticipate the surprise of my friend by such a beginning, but really, when I inform him, that his position is *favored* by an unintentional mistake upon my part, and, that it is positively true that the ball would strike *east*, instead of west, he will certainly add *incredulity* to surprise. But let conviction follow proof. The reasoning which has led to the above result, I have become acquainted with since my first communication was written, and, I presume with some confidence, that it is the understanding which the lecturer intended to convey.

It is a well known fact, that the rim of a carriage wheel moves much faster than the hub, and that the difference of velocity is according to the distance that the rim is placed from the centre of the wheel. This being admitted, we must allow, that the earth, revolving on its axis, must necessarily obey the same laws. Therefore, if the surface of the earth, at the equator, or four thousand miles from the centre, moves with a velocity of one thousand miles an hour, and the height of a steeple placed there, one hundred and fifty feet, the top of the steeple must move as much faster than the bottom as the distance is greater from the centre of the earth ; and a ball at the top having acquired the same progressive motion, when set free, goes forward, while falling, with the same velocity as the top, which is greater than at the bottom, and in theory is resisted less by gravity, than accelerated by the difference of the projectile force given at the top of the steeple, when compared to the bottom.

Therefore the ball would strike east of a point perpendicularly under it.

J. M. W.

For the Young Mechanic.

## NEW DISCOVERY.

A discovery has lately been made, which promises to be of great benefit to all classes of the community, especially to our mechanics, and particularly the younger portion of them. This contrivance, when put into extensive operation, possesses so much power, that the effects produced by the steam engine, dwindle into insignificance, when compared with the effects of this new machine. It is believed that suitable materials for the construction of these machines, exist in every section of this country; indeed, some persons are of opinion, that there are but few towns in which materials are not to be found more or less suitable for the work. The best specimens are found on the surface of the earth; in some places, however, great quantities are found far below its surface. Although they vary in size, form, and color, there is something characteristic about them, by which they may be easily known, when once pointed out. The grand obstacles in the way of constructing these machines, and putting them into operation, are the want of suitable tools and skilful workmen.

I have had an opportunity to witness the operation of several of these machines within a few months. One or two of them pleased me so much, that I was induced to attempt a description of them. The materials require considerable judgment in their selection, and they must be seasoned for years before they are fit for any part of the work. The main-spring or first mover, and some other parts, should be made of well tempered materials, for the several wheels, levers, &c. to be acted upon, are of such a nature, that they are subject to some irregularities in their movements. These difficulties, however, may be overcome by skilful management.

Like most kinds of machinery, the better the several parts are fitted and polished, the more likely they will be to perform well. But it appears necessary that the various rubbing parts should be kept in motion for some time before the machine can be said to be finished; for, after the workman has done his best, there will still remain many sharp edges, as well as protuberances and eccentricities, which had entirely escaped his notice, or their removal was beyond his art.

Those persons who have devoted most time and money towards perfecting this invention, do not wish to monopolize the business by a patent; but would be glad to furnish all the assistance in their power towards establishing them in various parts of the country. These machines are not of that class called labor-saving, but their introduction will have a direct tendency to lessen the expenses of many persons. The laboring class will reap their full proportion of the benefits, if they act wisely, and adopt them without delay; and there is no danger of too many being introduced,

as the article manufactured is not likely to become a drug in the market.

I was present the other evening at the anniversary celebration of the 'Boston Mechanic Apprentices Library Association,' at Chauncey Hall; where an Address and a Poem were delivered by two of the members. These exercises appeared to give general satisfaction to the numerous audience that attended on this occasion. This is certainly one of the most useful institutions in the city. The members have the sole charge of an extensive library, and they rent a room where they hold two meetings in a week, one for lecturing and debating, and the other for the distribution of books. At both meetings, when no exercises are going on, they amuse themselves by reading the papers, which they are supplied with by the kindness of our publishers. Their exercises create a demand for scientific books, that might otherwise be slumbering on their shelves. In addition to their library, they have commenced a cabinet of minerals, and specimens of the various kinds of wood, &c. Does not this afford a fine chance for the young mechanics of Boston to improve themselves?

Apprentices' libraries exist in various cities and large towns in the Union, and many more might be formed with advantage, especially if the young folks have exercises to perform. They will then have some inducements for study. When they are free, they will make good members of societies for mutual improvement. It seems necessary that there should be a link of this kind in the chain of that education, which begins as soon as we have any discernment, and continues as long as our faculties are preserved. We are learning all the time, and our minds will be filled with knowledge of some kind or other. Then it must be a great discovery, to find a plan, by which even the laboring class, may, by associating together, improve themselves in useful practical knowledge.

PHILO.

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For the Young Mechanic.

## POWER OF A STEAM ENGINE.

Messrs. Editors,—So long ago as last July, I saw an inquiry made through the Young Mechanic, as to the number of horse-power a steam engine is equal to, with steam seventy-five pounds to the square inch, area of piston twenty-eight inches, length of stroke two feet, double strokes, per minute, seventy-five. As I have seen no answer to it, I suppose every one who can give one is waiting for some one else to do it. But, for fear we should have none at all, I will show you how I should figure it out, and if I am wrong, I hope some one, better versed in these matters, will set me right.

$$75 \times 28 = 2100 \times 4 = 8400 \times 75 = 630{,}000 \div 33{,}000 = 19\ 1\text{-}11.$$

In the preceding line, I multiplied the pressure to the inch by the area of piston—that by the length of stroke both ways—and that by the number of strokes per minute. The result of this appears to be, that if only one pound were acted on, that power would be able to force it (friction excepted) a distance of 630,000 feet per minute; or if a weight of 630,000 pounds were acted on, it would raise it one foot in the same time. A horse power I suppose to be what is equal to that exerted by a weight of 33,000 pounds, descending at the rate of one foot per minute. This makes the engine of the power of nineteen and one eleventh horses, which is more than double what the engine is estimated at by the builder. In this, however, I have made no allowance for friction. How much should be allowed for this? I hope some of your correspondents will answer this question, and throw some light on the whole subject, as I suppose there are others besides myself who do not see it clearly. J. E. H.

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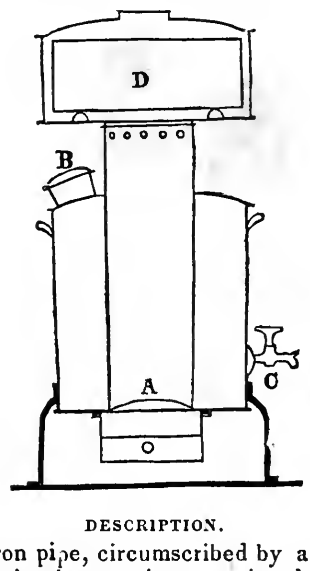
For the Young Mechanic.

## ANDERSON'S PORTABLE KITCHEN.

This simple contrivance seems to be a convenient, economical, and safe article of cooking apparatus. The principles of the invention consist in boiling and baking with the same fire.




DESCRIPTION.

A is is a sheet iron pipe, circumscribed by a tin cylinder. At the bottom of this pipe is a grating, opening downward, on which

the fuel, which is charcoal or anthracite, is laid. Beneath the grating is an ashes pan, with a small opening in the top of its front for the admission of air. B is a tunnel through which the water is poured into the cylinder. C is the outlet for the same. D is a sheet iron bake-pan, standing within a sheet iron cylindrical baker. The fuel is to be put in at the top of the funnel, when the baker is off. Instead of the baker represented in the cut, a coffee pot, or any vessel of the kind, can be placed on the top of the funnel. This machine is an improvement on the modern cooking furnace. It can be placed with safety on the hearth, in a shed, or in the open air. When occasion requires, a pipe can be attached to the top of the baker or funnel, to carry the smoke and gas into the nearest flue.

The inventor, Mr. Thomas K. Anderson, of this city, is about getting a patent for the above. EDS.

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From the Repertory of Patent Inventions.

## CURIOUS CLOCK.

THE Journal of Geneva gives the following description of a clock exhibited in that city, and made by M. Bianchi, of Verona. This machine, which is especially remarkable on account of its extreme simplicity, is composed only of a pendulum, a large wheel, two escapements, and a quadrature ; such are the visible parts. We must however suppose that a pinion and a wheel make the communication between the great wheel and the quadrature, though we cannot see them. The pendulum, at each vibration, causes one of the escapements to advance the great wheel one tooth, which, after this movement, has a pause marking the dead second. As there is no metallic moving power to set the machine going, we find, on examining what keeps up the motion, that the pendulum, which is almost out of proportion with the clock, descends into a case, and there, at each vibration, the ball, or bob, that is furnished with a conductor, approaches alternately two poles, to which voltaic piles supply their portion of electricity. So that the pendulum, when once put in motion, retains it by means of the electricity alternately drawn from the two poles. This machine, which is equally simple and ingenious, is worthy of the attention of the artist. Perhaps other interesting results may be obtained, by employing the electric fluid as a moving power, however slight the force such an agent may seem capable of communicating.

# Miscellany.

*Inventions Encouraged.*—Congress continues its wise and liberal plan of rewarding useful inventions. An act of July 3, authorizes letters patent to be issued to Thomas Knowles, of Manchester, Eng. for a machine for cotton ; to James Lang, of Greenock, for a machine to spin rope-yarn and duck twines ; and to William Steele, of Liverpool, for his atmospheric and re-acting steam engines : provided, that they introduce those alleged improvements into use in the United States within two years from date, and deposit models in the Patent Office in the usual time.

Thus mind exerted in any country, becomes useful to all countries, and arts and sciences spread among men.

Since that act, a most interesting improvement of the steam engine is announced to have been made by a Mr. Rennoldson, of S. Shields, in England, which is likely to come into universal use, if the description be accurate. It so combines three cylinders from one boiler, with connecting rods on a triangular crank, as to move three pistons with such uniformity and equability that the motion is scarcely felt. By this, a fly-wheel is dispensed with, and the machinery occupies less space than that hitherto in operation. These qualities will insure its general adoption by *steam-boats*, if its performance realize the account of this steam engine. In no part of the habitable globe would such an accession to the utility of steam-boats, be hailed with louder acclaim, than *here*, on the banks of the Mississippi, with its thousand rivers, lakes, and bayots.—*Louisiana Advertiser.*

*Blowing glass by machinery.*—Among the prizes awarded by the French Academy of Sciences, at their last sitting, was the following. 'To Israel Robinet, workman, for the substitution of the action of a machine, for that of the human lungs, in glass blowing, 8000 francs. By means of this valuable invention, the health of the glass-blower will in future be preserved, and the product of the manufacture greatly improved, both as regards accuracy of form and the capability of making articles of greater dimensions than was formerly possible.'

*Value of Printing.*—In 1274, the price of a small Bible, neatly transcribed, was £30, a sum equal to at least 2 or £300 of our money. A good and clearly printed Bible may now be had for 2 or 3 *shillings.* It is related that the buildings of the two arches of London Bridge cost only £25, which is £5 less than what a copy of the Bible sold for many years afterwards. These facts afford a curious commentary on the changes and advantages produced by the extraordinary invention of printing, which has done so much to

alter or shake all the institutions of the world, wherever the press has appeared.—*English paper.*

*Steam Boats.*—A Paris paper says that the French are about to follow the example of the U. States, in establishing lines of steam boats along the coast. Two superb boats have been built at Bordeaux, to ply between that port and Havre. A similar enterprise was in progress at Marseilles, and the boats which now run from that port to Naples, are to extend their communication to Havre, touching at the intermediate ports. Steam boats now run from Havre to Hamburg, and thence, during summer, to St. Petersburg.

## QUESTION.

Messrs. Editors,—If you think the following question worth a place in the Young Mechanic, it is at your disposal.

It is known to many artists that glass may easily be turned in a lathe to any form required, by applying spirits of turpentine to the common tools used for turning iron, &c. while cutting the glass. If any of your scientific readers can solve the question, why glass is so easily acted upon, by using spirits of turpentine, they will much oblige a subscriber.

W. W. C.

## TO READERS AND CORRESPONDENTS.

We have been repeatedly requested to publish accounts of the more difficult processes of art. Persons in want of information of this kind, are invited to make the same known to us, and the conductors of this work will render them what assistance they can. Those who have useful hints to give, are also invited to communicate the same. EDS.

THE

# YOUNG MECHANIC.

APRIL, 1833.

## CHEMISTRY.

[Continued from page 40.]

### OXYGEN.

*Dephlogisticated air, vital air, fire air, pure air, &c.*

OXYGEN was first discovered by Dr. Priestly in 1774; by heating red precipitate in a glass retort connected with a hydro-pneumatic apparatus. The merit of its discovery is also due to Scheele and Lavoisier, both of whom obtained it, a short time after, by different means, and before they were informed of Priestly's experiments.

It is transparent, colorless, inodorous, a non-conductor of electricity. It refracts light less powerfully than any other gas. It retains under pressure, its gaseous state. By sudden condensation, it becomes luminous and hot. Its specific gravity, air being 1, is 1·1111. 100 cubic inches at 60° F. Bar. 30 weigh 33·9 gr. Its combining weight is represented by 8.; hydrogen being considered as unity. Water at 60° F. absorbs about 1-27 of its bulk of this gas. It combines with all simple bodies. It is not affected by light. Caloric has no other effect upon it than that of expansion. It goes to the positive pole in the electro-galvanic circuit, and is therefore considered as electro-negative.

Oxygen is universally diffused throughout nature, but is no where to be found except in combination with other substances. The means of obtaining it are numerous. The following are those most generally adopted, viz:

1. By heating nitrate of potassa (saltpetre) in an iron retort or

gun barrel, at a temperature a little below redness. From one pound treated in this manner, about 1600 cubic inches oxygen gas will be obtained. The last portion of gas which is obtained, should be kept separate from the other, it being impure. The first portion which is separated is nearly pure.

Rationale.—Nitrate of potassa consists of nitric acid and potassa. Nitric acid consists of oxygen and nitrogen. When the salt is heated, a portion of oxygen is separated from the acid, and there remains a compound of nitrous acid and potassa in the retort.

2. One hundred grains of chlorate of potassa, heated in a glass retort, afford about one hundred cubic inches of gas. If it be collected over mercury, it will contain nothing but aqueous vapor, from which it may be freed by introducing a few lumps of caustic potassa.

Rationale.—Chlorate of potassa consists of chloric acid (formed of chlorine and oxygen) and potassa, (formed of potassium and oxygen.) When the salt is heated, all the oxygen is separated, and chloruret of potassium remains.

3. Sulphuric acid, one part, mixed with two parts powdered black oxide of manganese, in a glass retort, and heated moderately, affords oxygen gas, containing only about 1-40 or 1-50 of adulteration.

By this process a portion of the oxygen is separated from the manganese, and sulphate of protoxide of manganese remains.

4. Black oxide of manganese, heated to redness in a retort, parts with a portion of its oxygen. This is perhaps the cheapest and most convenient method of procuring it when a considerable quantity is wanted. Oxide of manganese frequently contains carbonate of lime; it should therefore before using, be washed with water acidulated with about 1-16th of nitric acid; otherwise the oxygen would be contaminated with carbonic acid gas. One pound of good oxide of manganese will yield about 1200 cubic inches of oxygen gas. A very convenient and cheap retort may be formed, for obtaining oxygen by this process, by inserting a bent gun barrel into the top of an iron quicksilver jar.

When oxygen has been collected over water, it is usually contaminated with air which it separates from the water. To obviate this, mercury, or water which has recently been boiled, may be used. The degree of purity may be easily ascertained by introducing a determinate quantity into a curved tube, closed at one end and filled with mercury, so as to occupy the curved part, and about one-quarter of the whole tube. Next introduce half a grain of phosphorus to each cubic inch of gas. Close the end of the tube with the finger, under mercury, and apply heat, with a spirit lamp, to the curved part of the tube, as long as any light is perceived. The phosphorus combines with the oxygen, and the finger being removed, and the tube cool, the mercury rises to take its

place. We have only to measure the gas which remains to learn the quantity of adulteration.

Oxygen is the principal supporter of combustion and animal life. A body while burning introduced into it, burns with much more intensity. A taper, the flame of which having been extinguished, the wick only remaining lighted, if placed in a jar of oxygen, will be instantly rekindled, and this may be repeated with a quart of oxygen thirty or forty times. If a watch-spring be used instead of the taper, one end of which being heated to redness, a brilliant and rapid combustion ensues.

Animals confined in oxygen live five times as long as they would if confined in the same bulk of common air. When respired into the human lungs, it generally produces a slight exhilaration, and an agreeable warmth in the region of the chest. It has been introduced into medical practice, but a considerable diversity of opinion seems to exist in relation to its value in cases of disease. There are however many cases on record of its having been resorted to with success in cases of drowning, and injuries to the lungs resulting from inhaling noxious gases. Chaptal gives an instance of a man in the last stages of consumption who respired oxygen gas. His strength increased rapidly; and in six weeks he was able to take long walks. His improved state of health lasted for six months, when he relapsed, and, unable to obtain more oxygen, he died.*

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## GEOMETRY AND ARITHMETIC.

[Continued from page 44.]

### ANGLES AND DEGREES.

*Definitions.*—A line is called straight, when every part of it lies in the same direction.

When two straight lines have the same direction, they are said to be parallel to each other.

When two straight lines have different directions, they are either converging or diverging. Two lines are said to be converging if when extended they grow nearer each other, and diverging, if the reverse takes place.

When two straight lines meet, they form an angle; the point at which they meet is called the vertex, and the lines themselves are called the sides of the angle. When a straight line meets another, so as to make the two adjacent angles equal, the angles are called right angles, and the lines are said to be perpendicular to each other. When two lines are neither parallel nor

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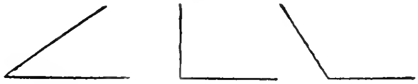
* Some interesting articles in relation to this subject, will be found in the American Journal, Vols. I and XVI, also in Tilloch's Philos. Mag.

perpendicular to each other, they are said to be oblique to each other.

Any angle smaller than a right angle, is called acute, and when greater than a right angle, it is called obtuse. The three kinds of angles are represented in the following diagrams.

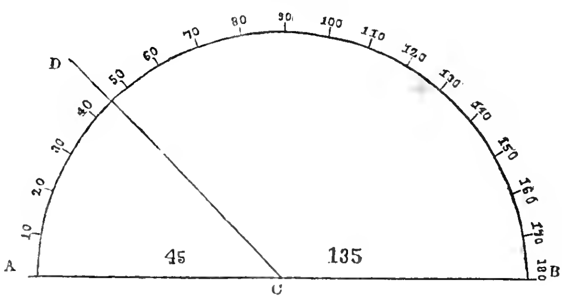
ANGLES.



Acute. Right. Obtuse.

The magnitude of an angle depends upon the degree of inclination, and not at all upon the distance or length of the lines. The nearer two lines are to being parallel, the smaller the angle, which becomes nothing when the lines become parallel. It increases as the lines diverge, until they form one straight line, when it ceases to be an angle. In measuring angles, a different plan has been adopted from that practised for lines, surfaces, and solids. These are measured by comparing each with a known quantity of its own kind as a standard, (see page 42.) But in measuring angles, the circle is used, which is a surface terminated on all sides by a curve line, returning into itself, all points of which are at an equal distance from a point called the centre of the circle. The curved line itself is called the circumference, and any part of it is called an arc. To measure an angle, then, is to find what portion of a circular arc is embraced by the two sides of the angle, the vertex of the angle being at the centre of the circle.

To obtain a clear idea of the magnitude of an angle, and the connection it has with a circular arc, let us suppose (in the annexed

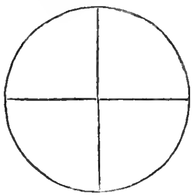



figure,) that at first the two lines D C and A B coincide in the part A C, and that the part D of the line D C be raised, so that this line, departing from A C, may revolve about the point C ; it becomes immediately inclined to A C ; which inclination increases until the part D coincides with B, or has described half a circle. We hence see

how an angle may be measured by dividing the circle into a great number of parts, and also how necessary that a uniform division should be adopted in all parts of the world, in order to make it extensively useful.

The ancients divided the circumference of the circle into 360 parts, called degrees ; each degree into 60 parts, called minutes ; and each minute into 60 parts, called seconds. And the magnitude of an angle they expressed by the degrees (°), minutes (′), and seconds (″), in that part of the circle between the sides of the angle ; thus an angle of 42 degrees, 23 minutes, 19 seconds, is usually written 42° 23′ 19″.

As the circle is divided into 360 degrees, a half circle will contain 180, and a quarter 90 degrees. A circle contains four right



angles, each embracing a portion of the circle equal to ninety degrees. A right angle, then, is an angle of ninety degrees. The semi-circle above is divided into 180 degrees ; each division contains 10 degrees ; the acute angle embraces 45, and the obtuse angle 135 degrees. Several lines may be drawn from the same point in a straight line, forming many angles ; but the sum of all the angles from the same point, and on the same side of the line, will be equal to two right angles or 180 degrees.

APPLICATIONS.

Many instruments are constructed upon the principles explained above, and are used for a great variety of useful purposes. Most of those used by surveyors for measuring angles in the field, have a circle, or a part of a circle belonging to them, divided into degrees, which render the operations easy and exact. When these angles are to be transferred to paper, a protractor is used ; which is generally found in a case of drawing instruments, and is described in the Young Mechanic, vol. 1, p. 131. Sometimes the degrees are marked on the joint of the common rule, which enables mechanics to take the dimensions of angles, and commit them to writing with as much ease as they do those of length and breadth.

By means of graduated circles, we trace the course of heavenly bodies, discover their movements, measure their distances and their size, and predict the moment of an eclipse, or the return of a comet. The needle of the mariner's compass, always directed towards the north, points out to the navigator, on a graduated circle, whether he pursues his proper course, or how much he departs

from it. Geography only represents to us with so much precision the position and relative distances of all the points of the earth, by making use of two graduated circles, one extending round the earth in the directions of east and west ; and the other north and south ; the degrees of one being longitude, and of the other latitude. It may indeed be said that without the graduation of the circle, which, simple as it appears, was slowly invented, the arts and sciences, and consequently civilization, would be far inferior to their present state. PHILO.

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For the Young Mechanic.

## ARCHITECTURE—No. II.

It is the design of this essay to notice, very briefly, the state of the art of building during that period of the world on which *profane* history casts no light. Taking the writings of Moses as containing the earliest history of man, we shall be led to conclude therefore, that architecture very early became an object of primary importance.

According to Moses, the keeping of sheep, and the cultivation of the earth, were the first employments of the human race. It is easy to conceive how the first of these occupations could be profitably pursued, without necessarily requiring the erection of regular and permanent buildings. For, as this sort of life was wholly of a roving character, tents, or buildings as easily moved from place to place, would have been the most proper and convenient. We therefore find, that the patriarchs, who were keepers of flocks and herds, are spoken of as dwelling in tents.

But wherever *agriculture* is carried on to any considerable extent, there permanent and commodious buildings will be almost indispensable. Accordingly we find that agriculture and architecture are coeval. Adam was an agriculturalist ; and his son Cain was both an agriculturalist and a builder :—' *He builded a city and called the name of it after his son Enoch.*'

In the time of Cain's immediate descendants, or, according to the Mosaic chronology, in about nine hundred years after the creation, architecture must have attained considerable perfection. The fifth generation from Cain was characterized for its skill in the arts. Articles of brass and iron were manufactured, musical instruments invented, and music systematically taught. And it cannot reasonably be supposed that amidst these improvements and inventions, an art so essential as that of building would have been neglected. On the contrary, we may safely conclude that architecture would have been one of the first objects to which an agricultural and mechanical people would devote their attention.

The building of the Ark in the seventeenth century of the world affords another evidence of the improved state of architecture

among the antediluvians. For, although Deity himself was the architect of this structure, yet man must have possessed a previous knowledge of the principles of building, in order to enable him to understand the plan, and to carry it into execution.

The building of the city and tower of Babel, on the plain of Shinar, in the eighteenth century of the world, demonstrates that knowledge of the art of brick-making, and the nature of cement existed at that period.

Another proof of the statement, that architecture must have been considerably improved in the time of Moses, is founded on the minute specifications which Jehovah gave to him for the construction of the tabernacle. Those particular directions illustrate the perfection to which the arts in general had attained at that period. And as all arts and sciences generally flourish and decay together, it is fair to conclude that architecture was as much improved as any of those arts which were called into requisition in the building and decoration of the tabernacle. Indeed, that structure was itself a specimen of architecture, to which the other arts were subservient.

D. B. H.

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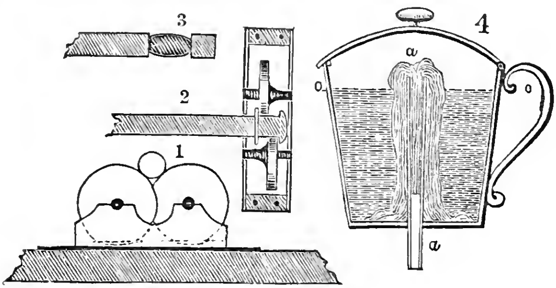
For the Young Mechanic.

## METHODS OF REDUCING FRICTION.




Friction, or attrition, is produced by the rubbing of the surfaces of bodies in motion; which is increased according to the surfaces in contact, their roughness, and the weight which they sustain. The remedies that have been applied to diminish friction, are almost innumerable; some are complicated, while others are both simple and useful, and to which, we shall chiefly direct our attention.

It is very desirable that all rubbing surfaces should be as smooth and even as possible, which will of itself conduce much to the reduction of friction ; this however applies more particularly

to rolling surfaces, such as the axle of a wheel; as in very flat, broad surfaces, the friction is increased, in consequence of cohesive attraction; and therefore the sliding parts of lathes, printing-presses, &c. should be supported upon narrow and intersected bearings. The most common method of reducing friction, where there is considerable weight, is, by having the rolling axles rest upon wheels or rollers, which have been applied in a variety of forms to accomplish different objects. A contrivance called an anti-attrition axletree, was made by cutting a cavity lengthwise in the under side of the axletree, and introducing a cylindrical roller, which, (the inventor said,) was found by experiment to be an advantage of three to one. Another method was, by having between the axle and nave a hollow space, to be filled up with solid equal rollers, nearly touching one another, with axles inserted into a circular ring at each end, by means of which their relative distances were preserved.

The simplest and probably the best arrangement of wheels for overcoming friction, are those represented in fig. 1, where it will be seen the wheels overlap each other so as to form a place for the axle to rest securely between them without wedging. It is recommended by some, to have the wheels and axle attached in such a way that both may turn together, to obviate the difficulty frequently experienced by the wearing of grooves in the wheels, from the want of oil, or some other cause, by which their action is stopped. The advantage gained by the use of friction wheels is according to the proportion which the primary axle bears to the circumference of the peripheries and axles of the friction wheels. Thus, suppose the circumference of the primary axle to be three, that of the periphery of the friction wheel twelve, and their axles one, the operation will then be as follows: the primary axle turns round four times in turning the friction wheels once, which would reduce the friction to one-fourth, if the axles of the friction wheels and the primary axle were of the same size; but, as they are only one-third as large, the friction is still further reduced in a three-fold ratio, or to one-twelfth, because the rubbing surface is only one-twelfth as great as it would be if the primary axle turned in boxes. By this it will readily be seen why these are so extensively used in railway carriages. It is, however, not merely on account of the great weight transported by them, but the speed and weight united would otherwise generate so much heat as to produce great injury to the machine.

When wheels are supported by the common cylindrical axle, revolving in boxes or a cavity, the axle and box should never be of the same metal, as they will produce more friction and more wear than when they are of different kinds. Thus a wrought iron shaft will work best in brass or cast iron boxes; and the same will apply to steel when soft, but if hardened and kept oiled, both shaft and box may be of the same metal. As a general rule, however,

it is best to have them of different metals, whether the shaft works in boxes, or on friction wheels.

We now come to a very important part of our article, viz. the materials for and methods of lubricating machinery. It is doubtless well known that the most perfect polished work is, when examined through a microscope, extremely rough and covered with ridges ; and to remedy the imperfection we are obliged to apply oil, or some other substance to fill up the roughness, and thus keep the work in order. It is likewise important that the unguent applied should be according to the finish of the work ; for instance, the oil used for a delicate watch should be of the purest and most limpid kind, whereas for a rough cart wheel, tallow, mixed with black lead, has sometimes hardly consistency enough. In mills and other places where considerable wood is used in the machinery, tallow, with a large proportion of black lead, may be applied, as a very good anti-attrition mixture. A species of mineral called Talc, which is of a very unctuous nature, and common in New England, is sometimes used in heavy mill work instead of black lead, and by some it is thought to be equal, if not superior for such purposes. But for my own part, I am inclined to believe black lead incomparable as a dry anti-attrition substance, for it can not only be applied in many cases instead of oil, but will answer well where oil would be entirely useless. In Europe it has been used in the following manner for preventing friction in watch movements ; fine black lead was washed a number of times in water until all the gritty particles were separated, when the water was separated from the residuum, which was then mixed with alcohol, to the consistency of common paint, and applied with a camel's hair pencil, to the holes and pivots of the watch, where, after the alcohol had evaporated, a coating of the purest black lead remained, which was examined several years afterwards, and found to be better (if possible) than at first.

I have noticed many instances, where I have thought black lead could be applied with advantage, especially where articles are exposed to considerable heat. It is common in foundries, when a casting is to be removed, as the nut of a large screw, to apply a thin coat of clay, that it may be the more easily removed ; but the clay has often so much sand and grit, that it retards instead of assisting. Screws and bolts attached to steam engines, bottle-moulds, &c. subject to heat or rust, could be removed without difficulty, if they had been coated with clean black lead. Although black lead is very useful, yet oil is not the less so, for according to the opinions of Geo. W. Smith Esq. and Mr. J. Mc-Ilvaine, given at a monthly meeting of the Franklin Institute, pure sperm oil is the *best* unguent for diminishing friction of railway cars, locomotive engines, and other machinery of similar construction. And Mr. McIlvaine likewise recommends, 'that the oil should be carefully cleansed and deprived of those parts which water could remove.'

We perfectly coincide with the above, as applied to those purposes, and will now proceed to describe the methods of applying it. By referring to fig. 1, you will perceive a dotted line near the bottom of the box containing the friction wheel, intended to represent a quantity of oil, a portion of which is carried on the circumference of the friction wheels, and thus lubricates the axle revolving on them. To prevent the waste of oil by passing along the axle, a collar is attached, as delineated in fig. 2, to act as a check, as the centrifugal force keeps the oil within the box when in motion, and when still it has but little tendency to run up hill. This is the principle upon which the wheels of the Baltimore Railway carriages are oiled, and gives great satisfaction in consequence of its being continual.

Fig. 3 represents the form of a bearing for a shaft running in boxes, which is very favorable for retaining the oil; sometimes the boxes have a spiral groove through them, but it is not generally thought desirable.

A beautiful method of lubricating fixed machinery, was contrived some years ago by Mr. John Barton, a drawing and description of which, I have extracted from the London Mechanics' Magazine. 'It consists of a tin vessel, as delineated in fig. 4, having a tube *aa* passing down through it, and a cover to keep out dust, &c. A number of cotton threads are placed with one end down the tube, the other ends laying over the sides, and descending to the bottom of the vessel. The cup being filled with oil to the line *oo*, and the small tube *a* inserted in the upper box of the tube, the cotton fibres become a syphon acting by capillary attraction, which slowly and gradually conveys the oil down the tube, to the axle to be lubricated. By increasing or diminishing the quantity of cotton, the flow of oil is regulated to suit the consumption of the machine.' J. M. W.

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## ROLLING HELIX LEVER WATCHES.

An invention has been made by Mr. M'Couall of Leeds and Wakefield, which promises to be of important use in watch and clock making and every kind of machinery. The invention is a new and very superior method of communicating motion from one wheel to another, by what the inventor calls the *rolling helix lever*. The inventor gives the following account of it :—Of this Helix Lever the following are the valuable and distinguished properties. First; it passes over equal spaces in equal times, and consequently is at all times at equal distances from the centre of motion ; a perfection never before accomplished by any practical method of communicating motion. Secondly, it has a continued line of centres, and a single point of contact. Thirdly, its pressure is always in a line parallel to its axis, by which all the friction of

shoulders is avoided. And lastly, it has a rolling action which materially reduces the friction at the point of contact. In communicating motion by means of toothed wheels, it is evident that every tooth must transmit some degree of imperfections on coming into action, and on ceasing to act, and consequently imperfections will be multiplied, in proportion to the number of teeth. An examination of a yearly clock on the old principle, and one on that of the new, will immediately evince the immense superiority of the latter in this respect. On the old principle the number of teeth is 1272, and the number of consequent imperfections 148,000,000. On the new principle the number of teeth is 130, and the number of consequent imperfections 179,760. This striking fact clearly establishes the vastly superior accuracy of the new principle as applied to all mechanism designed for the measurement of time. If a machine, constructed upon the old principle, to produce a certain quantity of motion, requires a moving power of 192 ounces or 12 pounds ; one, constructed upon this newly invented principle, will produce the required motion with the wonderful small power of six ounces. This great superiority arises from the peculiar construction of this lever, and its particular mode of action, which places it so decidedly above every other invention yet presented to the public. By means of this, the inventors have been enabled to construct an eight days' clock, with only two wheels and only requiring a weight of six ounces, while one constructed upon the old principle, requires four wheels and three pinions, with a weight not less than twelve pounds to keep it in motion.

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## PATENTS FOR MASSACHUSETTS.

*Granted in June and July,* 1832.

From the Journal of the Franklin Institute.

For a *Cooking Apparatus*, called 'Day's economical furnace, oven and boiler ;' Samuel D. and William T. Day, Westfield, Hampden County, Massachusetts, June 8.

A round furnace made of metal, or clay, contains the fuel, and over this furnace, boiling, and other operations, may be performed. There are openings at one side of the furnace, consisting of round holes, or else grate bars, against which is put what the patentees call a tunnel : this is an oven of a particular form, in which roasting, baking, &c. are to be carried on. There is no claim made, nor are the superior advantages of the apparatus manifest to us either from the drawing or description, although each of them has been prepared with much care.

For an improvement in the *Tin Kitchen ;* George Richardson, South Reading, Middlesex County, Massachusetts, June 14.

This, we are informed, is made like the ordinary tin kitchen,

excepting that it is nearly of a square form, with the sides, bottom and back in entire pieces, to exclude the external air; there, however, is to be a close-fitting lid on the top, or in the back, notwithstanding its entire unity. A shelf, or shelves, may be placed on ledges within, or there may be a spit crossing it in the usual way. The tin case, and also the separate pieces, are to be so formed and placed as to reflect the heat where it is most wanted. In what part the claim to a patent resides, we are not informed.

For an improvement in *Clocks;* Rufus Porter, Billerira, Middlesex County, Massachusetts, June 22.

Some new combinations are made in the escapement, and in the arrangement by which the hour hand is acted upon. There is to be an alarm, the weight of which, in its descent, acts upon a lever, and causing it to strike upon one of the magic matches, the match is inflamed, and this in its turn lights a candle. These are the points claimed.

For a *Rotary Pump,* called the 'Spring or drop valve pump;' Eli Kendall, Ashby, Middlesex County, Massachusetts, June 22.

This pump is on the same principle with a number of other rotary pumps and steam engines. There is an outer cylinder or drum, with closed ends, and within this an inner cylinder is made to revolve by means of a crank attached to one of its gudgeons, which passes through the centre of one of the heads of the outer cylinder. The chamber of the pump is the space between the inner and outer cylinders. This chamber has a partition, or stop, filling it up at one point; at one side of this partition is a tube for admitting, and at the other a tube for discharging water. Two metallic valves, filling the capacity of the tube, slide into the inner cylinder as they alternately pass the partition, being forced to do so by the bearing of their outer ends against a strip or plate of metal which acts upon them as a cam.

There is no claim made, and as we have frequent occasion to remark, little or nothing upon which to found one.

For a *Standing Press;* Aaron Hale, Boston, Massachusetts, June 26.

For a *Brand, for branding Barrels, Packages, &c.;* Samuel Huse, Newburyport, Essex County, Massachusetts, June 28.

For an improvement in the *Mode of pointing pegs and pins;* James Hall, North Bridgewater, Plymouth County, Massachusetts, July 7.

The points upon pegs, or pins, are to be formed upon the face of the block, before the pegs or pins are split out. To effect this, a shaft carrying the necessary cutters, is made to revolve horizontally. These cutters may be formed of plates of steel, like circular saws, but having their edges bevelled in such manner as shall

give to the point of the peg the form which may be required. A number of cutters of this description may be passed on to the shaft and held there by a screwed nut. Instead of so forming the cutters, grooves may be made around a steel cylinder, and the teeth be formed by filing across them. The patent is not taken for any precise mode of making the cutting tool, but for the modes of construction whereby a circular motion is given to the teeth when in operation, and thus forming the points, as set forth in the specification.

For a *Socket Spade;* Charles Richmond and Samuel Caswell, Jr. Taunton, Bristol County, Massachusetts, July 13.

For a *Double Coffee Mill;* Thomas W. Witherby and Joseph Torry, Millbury, Worcester County, Massachusetts, July 17.

The difference between this mill and the cast iron vertical coffee mill used by most persons, consists in its being furnished with two revolving toothed nuts, covered by two corresponding shells. One handle serves to turn both ; and one regulating screw to set them. The hopper has a moveable partition in it, allowing two different articles to be ground, without their interfering with each other ; or, of course, both may be used for the same article.

For a *Cotton Spreading and Picking Machine;* John C. Whitin, Northbridge, Worcester County, Massachusetts, July 20.

This spreading and picking machine is constructed like some others now in use, but the wire cylinders are to have a flanch, or heading on each end, projecting about two inches, so as to retain the sheet or lap of cotton, with a smooth, compact edge. All the moving cylinders, rollers, &c. excepting the beaters, are to be geared, and these are to be run as usual by straps. The claim is to 'the application of gearing to the several movements, instead of belts, and of the flanch or rim to the ends of the several wire cylinders.'

For a *Machine for Grinding Cylinders which require to be perfectly straight and true*, called a 'Traverse Grinder;' Jonathan Bridges, Troy, Bristol County, Massachusetts, July 24.

Steel and other cylinders, are frequently ground perfectly true by fixing a stone, or other grinder, upon a shaft parallel to that of the cylinder, and causing it to traverse from end to end of the cylinder ; a rotary motion, generally in opposite directions, being given to each. The shaft of the grinder is, in this case, made cylindrical, that it may slide within collars at either end of the machine. The shaft of the grinder must, necessarily, be at least double the length of the cylinder to be ground. The present invention is for an application of the same mode of grinding, but by machinery which is differently arranged. The shaft upon which the stone or other grinder is placed, does not traverse backward and forward, but the grinder itself slides from end to end of the

shaft. The latter is made cylindrical, and is grooved from end to end, and a piece projecting from the hole in the grinder into the groove, prevents it from turning round upon it, and guides it as it traverses along. There are pulleys placed upon the shaft of the cylinder to be ground, bands from which give motion to the grinder shaft. The apparatus which gives the traversing motion to the grinder, would require an engraving for its perfect explanation. The claim is to the particular arrangement of the machinery by which this is effected.

It is contemplated to apply this instrument to the grinding of cylinders of all kinds, whether of wood or metal, and particularly to piston shafts and card cylinders. In grinding cards it is observed that it may be fixed in the place of the doffer cylinder, and moved by means of a bolt from a pulley on the main card cylinder shaft, its construction admitting of its being carried to the body to be ground.

For machinery for finishing the ends of *Bobbins or Spools;* Simeon Presbury, Jr. Canton, Norfolk County, Massachusetts, July 26.

This patent is taken for an apparatus used in finishing off the ends of the bobbins or spools used in spinning machines, so as to render them perfectly true and uniform, and to correct them should they become untrue by warping or otherwise. The patentee states that the inconvenience frequently experienced from the irregular draft of the spools, results in general from a want of truth in the ends of the bobbins, a defect which this contrivance is calculated to remedy. The apparatus consists of a mandril or pin, of the size of the spindle upon which the bobbin is intended to run. Upon this he fixes cutters, usually three, which stand at right angles to the pin ; or they may vary from a right angle when required. An enlargement or hub is made upon the pin for the purpose of attaching the cutters, or they may form one piece with the hub, which may slide on to the pin, and be secured there, whilst it is capable of being removed to sharpen the cutters. The claim is 'to the application of the aforesaid revolving cutters, or other modifications thereof, to the making or repairing of all kinds of bobbins or spools used in spinning.'

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## THE BURNING SPRINGS.

FLORIDA CO. (KY.) APRIL 27, 1832.

*Dear Sir,*—In the prosecution of my Sunday School Agency, I yesterday reached this place, in the immediate vicinity of which is the Burning Spring, and truly it is a curiosity. On approaching it I heard it boiling with a noise equal to that of a fifty gallon kettle over a hot fire. It is situated near the shore of a hot creek, which winds its way through a deep valley between the mountains

near the road side. There is a hole in the ground, about two or three feet deep, and about the same in diameter, which, after the rain, is filled to the top with water that is kept perpetually and briskly boiling by the gas which issues from a narrow space between two rocks at the bottom. This water is always kept muddy, but never runs over except by an unusual quantity of rain.

After viewing it for a few minutes, a lighted taper was applied to the ascending gas, and instantly the whole surface was covered with a blush red flame three feet high, emitting a smell similar to that of burning alcohol, and with an intense heat. Thus it continued to burn for an hour, while I remained, and I left it on fire.

The blaze, on a dark night, I am informed, illumines the whole valley and circumjacent hills, and never goes out but by the effort of a man, or the descending shower.

If nothing interferes to extinguish the flame, it continues to burn, the water becomes heated and evaporates, when the issuing gas, burning with more intense heat, consumes whatever combustible substance may be thrown into the water; and even the collected mud at the side of the hole is pulverized with heat as at the mouth of the surface.

Were this gas suitably confined and directed, I have no doubt it might be used for some valuable purpose, either to drive a steam-engine, or illuminate a city; but no use is made of it, nor does the owner of the land seem to regard it with interest, or as a curiosity.

Whence this gas, or whatever produces it, I leave to the conjectures and experiments of the learned, being confident it is the most singular phenomenon I have ever seen.—*S. S. Jour.*

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## COLOR OF THE AIR.

We are informed by the Cabinet Cyclopedia, that the same principle of vision which makes the sea colorless and transparent when surveyed in small quantities, but deep green when looked upon in the mighty deep itself—is applicable to the air. The air which fills an apartment, and immediately surrounds us when abroad, appears colorless and perfectly transparent. But when we behold the immense mass of atmosphere through which we view the firmament, the color is reflected with sufficient force to produce distinct perception. But it is not necessary for this that so great an extent of air should be exhibited to us as that which forms the whole depth and thickness of the atmosphere. Distant mountains appear blue, not because that is their color, but because it is the color of the medium through which they are seen. Thus, Campbell, philosophically as well as poetically, remarks that

——'distance lends enchantment to the view,
And robes the mountain in its azure hue.'

## BOSTON MECHANIC'S LYCEUM.

This Society has just completed its third course of exercises, consisting of lectures, debates, declamation, and extemporaneous speaking. These exercises have been conducted by the members alone, and the result plainly shows, that mechanics and others can conduct societies of this kind on purely mutual principles, exchanging knowledge for knowledge, and amusement for amusement, to the pleasure and profit of all concerned.

The Managers for the ensuing year are, Timothy Claxton, President; Dunbar B. Harris, Secretary; Joseph M. Wightman, Treasurer; William Grant and George P. Oakes, Curators.

There is also a committee to solicit candidates for membership, viz: George B. Proctor, John P. Farmer, Francis B. Winter, William S. Baxter, and Charles T. Young.

The annual assessment is one dollar, payable at the commencement of the season.

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## QUESTIONS.

Messrs. Editors,—If any of your correspondents will answer the fol lowing questions, they will oblige A SUBSCRIBER.

What occasions the singing (as it is called) of a tea-kettle before boiling?

What produces the rumbling noise we hear when hot iron is plunged into water, or steam let into a cold vessel?

Why does a razor shave better when hot?

THE

# YOUNG MECHANIC.

## MAY, 1833.

### CHEMISTRY.

[Continued from page 55.]

#### NITROGEN.

*Azote or Azotic gas, mephitic air, phlogisticated air.*

This gas exists abundantly in nature. It enters into the composition of all animal substances, and in all those vegetables that emit an animal odor while putrifying; such as cabbage, mustard, mushrooms, &c. It is found in the waters of Bath and Buxton, and is evolved from several native hot springs. Combined with oxygen it forms the atmosphere, and with oxygen in other proportions and with other bodies it unites, forming important compounds which will be mentioned hereafter. It was discovered by Dr. Ruthford, in 1772. Nitrogen must be considered as a simple body. It has been supposed to be compound. Berzelius calls it *suboxidum nitricum*, the nitricum being a hypothetical element, of which this is supposed to be the protoxide.* Its specific gravity, according to Thomson, air being unity, is 0.9722.

Weight of 100 cubic inches 29.65 grains.

Its combining weight is 14, hydrogen being 1. Its capacity for heat, according to Dr. Crawford, is 7936.

It is attracted to the negative pole in the electro-galvanic circuit, and is therefore considered as electro-positive.

Water which has been freed from air by boiling absorbs about 1 1-2 per cent of this gas.

It is transparent, colorless, tasteless, and without odor. At the usual temperature and pressure of the atmosphere it is perma-

* When any of the salts of ammonia (an alkali which contains nitrogen) are galvanised with mercury an amalgam is formed; from this it has been inferred that the base of nitrogen was a metal.

nently elastic. It refracts light feebly. It is not combustible or a supporter of combustion, and is fatal to animal life. The death of an animal confined in it does not proceed from any noxious quality which it possesses, but from its inability to support life.

There are several processes by which nitrogen may be obtained.

1. If phosphorus be burnt in a confined portion of atmospheric air, it combines with oxygen forming phosphoric acid, and nitrogen remains, combined however, with a portion of carbonic acid, which may be separated by agitating it with a solution of caustic potassa.

2. Lean meat digested in a retort with nitric acid of sp. gr. 1.20 with a gentle heat affords nitrogen by a decomposition of the meat. The fibrous parts of animal matter afford the most nitrogen—gelatinous substances afford the least. The meat should be fresh, otherwise the nitrogen obtained will be contaminated with other gases.

3. Sulphur and iron filings, about equal parts, or sulphur and potash, mixed together, moistened with water, and placed under a bell glass, absorb the oxygen of the atmosphere contained therein in three or four days and nitrogen gas remains. During the action which takes place, the air diminishes in bulk, when this ceases, it should be removed from the iron filings and sulphur, as it would otherwise become contaminated with sulphuretted hydrogen.

4. A solution of sulphate of iron saturated with nitrous gas, agitated with air, combines rapidly with the oxygen, and nitrogen gas remains.

5. If 100 measures common air be mixed with 80 measures nitrous gas in a wide vessel over water, 79 measures of nitrogen gas remain.

Nitrogen, when prepared by any of the foregoing methods, if required pure, should be agitated with lime water, in order to separate the carbonic acid which it contains.

Mr. Faraday's method of detecting minute portions of nitrogen is as follows :—Into a glass tube 4 or 5 inches long, and $\frac{1}{4}$ of an inch in diameter introduce a piece of zinc foil, above it a piece of potash, and about two inches above the potash, a piece of turmoric paper moistened with pure water. The test paper will indicate an alkali, when the potassa is melted by a spirit lamp, and the color will be discharged when the paper is withdrawn.

## GEOMETRY AND ARITHMETIC.

[Continued from page 58.]

### TRIANGLES.

A triangle is a figure of three sides and as many angles. A method to find the area of a triangle is given at page 25.

Triangles are of different kinds, according to the proportions of their several parts.

Fig. 3.

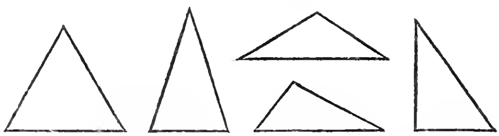


Fig. 1. Fig. 2. Fig. 4. Fig. 5.

An equilateral triangle has all its sides equal, as fig. 1.

An Isosceles triangle has two equal sides, as figs. 2 and 3.

A scalene triangle has all its sides unequal, as fig. 4.

A right-angled triangle is one that has in it a right-angle, as fig. 5.

A triangle cannot have more than one angle as large as a right angle, and the side opposite to the right angle is called the hypothenuse, which is always the longest side.

An obtuse angled triangle has one obtuse angle, as figs. 3 and 4.

An acute angled triangle has all its angles acute, as figs. 1 and 2.

An isosceles, or scalene triangle, may be either right-angled, obtuse, or acute.

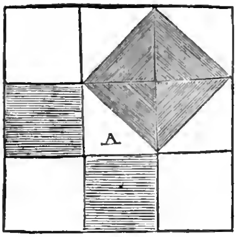
Any side of a triangle is said to subtend the angle opposite to it.

There are many problems on triangles. I shall give two of the most useful.

*Problem* 1*st*. The sum of the three angles of every triangle, is equal to two right angles, or 180 degrees.

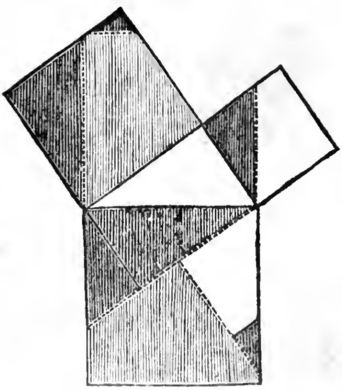
Although this cannot be demonstrated geometrically without a diagram, and a previous knowledge of the properties of parallel lines, yet it can be done mechanically, by forming a triangle of a piece of card, cutting off the angles, and placing them together on one side of a straight line; it will be seen that the three angles occupy all the angular space of half a circle, or two right angles.

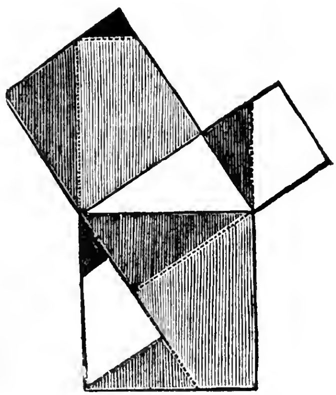
*Problem* 2*d*. The square described upon the hypothenuse of a right-angled triangle, is equivalent to the sum of the squares described upon the other two sides.




In the annexed diagram are 9 squares, all of the same size. The centre square is divided into two equal parts; one of which marked A, is the right-angled triangle; upon the hypothenuse, the large shaded square is described, consisting of 4 half squares, which is equal to the 2 squares, described upon the other two sides.

In the above example, two of the sides of the triangle are equal, but the rule holds good when they are unequal, as may be seen by the following figures.





The different shades of color in these diagrams, show the parts which correspond with each other, and the whole may be proved correct by drawing the figures, and afterwards cutting them into the several pieces marked, and applying them to each other.

## APPLICATIONS.

By problem first, we are taught the number of degrees in the three angles of every triangle; of course, if two angles are given, it will be very easy to find the third, or if one angle is given, we can tell how many degrees are contained in the other two.

Problem second, teaches how to find one of the sides of a right-angled triangle when the two others are given. If, for instance, we wished to find the length of the hypothenuse of a right-angled triangle, and the other two sides were known to measure, one 6, the other 8 feet, the sum of their squares 36 (6 times 6) and 64, (8 times 8) equal to 100, would be the area of the square of the hypothenuse; the square root of that number would be 10, the length of the hypothenuse itself. If the hypothenuse and one of the sides are given, you need only subtract the square of the

side from the square of the hypothenuse, and then the square root of the remainder is the other side. If, for instance, the hypothenuse of a right-angled triangle were 5 feet, and one of the sides 3 feet, the square of the hypothenuse would be 5 times 5, or 25, and the square of 3, which is 9, subtracted from 25, leaves 16, which would be the square of the side to be found; and taking the square root of it, which is 4, (because 4 times 4 are 16) you will have the side itself.

This is called the Carpenters' Theorem, or the 6, 8, and 10 rule; because these numbers are in proper proportion, and if they represent feet, they are of convenient length in squaring large frames; for if you make a mark at 6 feet from the corner of a square on one side, and another at 8 feet on the other side, these marks will be 10 feet apart if the work is square. By this rule, the length of a ladder, a shore, or stay of any kind, that will reach a certain height may be found, by knowing the height, and how far the foot is to stand from the building.

For the discovery of this principle, we are indebted to Pythagoras, a famous Greek mathematician. It is a very important one, and a method of proving it geometrically, was long a desideratum with the ancients. The Philosopher was so overjoyed on making this discovery, that he is said to have sacrificed a hundred oxen.

PHILO.

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## DIVIDING PLATE FOR A LATHE.

I have found a dividing plate on the pulley of a lathe, a very useful appendage. To divide one accurately is rather a difficult task. Having, after several fruitless attempts, hit upon a plan which I consider very practicable, and at the same time accurate, if done with care, I have thought it of sufficient importance to lay before your readers.

Having prepared a plate of brass the size of the pulley, namely 8 1-2 inches external diameter, 2 inches wide, 4 1-2 inches internal diameter, 1-8th of an inch thick, with a projecting circular rib at the back of the plate to strengthen it, this is fastened on a cast iron pulley with small brass rivets. It requires great care to make a wood pulley that will remain true.

Sometimes the holes in the concentric circles are drilled on the plain face of the brass plate; others have slight grooves turned where the holes are to be. I turned 11 grooves in my plate; and after dividing them and finding several intermediate numbers wanting, I drilled 10 other circles on the plain face between the grooves, so that I have 21 circles divided in the space of 2 inches in breadth, and are much less confused than they would have been had they been all in grooves, or all on the plain face. The method of dividing is as follows:—Prepare a punch with several oints, (the one I used had 7 points, 1-12th of an inch apart,) cut

by holding it against a steel screw running in the lathe, the same way that screw tools or chasers are made; after rounding these points with a file, the punch must be tempered; then prepare a piece of sheet brass long enough to receive as many holes as you want in the largest circle; it may be from half an inch to 1 inch wide, and about 1-32nd of an inch thick; it should be straight and smooth; draw a line in the middle of the plate, from end to end; then with your punch commence at one end; strike the blow in such a manner that the first point may make the deepest impression; then shift the punch one hole only, pressing the punch firmly into the six impressions made by the first blow; proceed in this way one hole at a time, and you will not be able to detect any error with the compasses. The holes may be finished with a small drill. The next step is to form this plate into a ring, and join the ends; this may be done by cutting a notch at one end of the plate 1-4th of an inch wide and half an inch long, leaving a narrow strip on each side, with two holes in each strip for rivets; these strips should be set outwards the thickness of the plate, to allow both ends to butt together, and the ring to be smooth inside; the end of the plate between the two strips should be filed so as to leave half a hole; the tenth hole from that should be marked; proceed in this way, marking every tenth hole, to the end; count off as many holes as you want, reckoning the two half holes at the ends as one. In cutting off the end it is best to leave rather more than half a hole, and when the ends are brought together, the hole may be adjusted by filing. If a darning needle will fit this hole, as well as any other, there cannot be much mistake; the ends may be held by a hand vice until some of the rivets are put in.

Having obtained a circle divided accurately, the next step is to tranfer it to the dividing plate, which we will suppose already on the lathe pulley; let an arbor, one foot long and half an inch square, be put into the lathe ; if the mandril has a square hole, so much the better; if not, a chuck with a square hole, screwed on tight, will do, as the arbor must not be allowed any side movement; on the end of the arbor, next the sliding head, a piece of seasoned wood must be put on secure, and turned to receive the ring, this may be kept from shifting by two or three small tacks; from the lathe-bed a piece of steel, rather springy, should extend up as high as the centre of the lathe, terminating in a point bent at a right angle so as to fall into the holes in the ring, and hold it fast while the dividing plate is being drilled; the drilling apparatus consists of a small drill with its arbor all of one piece of steel, (for if the drill gets lose it makes bad work,) on the arbor is a small pulley which is worked with a cane drill-bow in the left hand, the drill is put into a small frame which fits into the hole in the rest, and may be moved sideways, or up and down at pleasure, the drill is urged forward by a screw with the right hand and thrown back

by a spiral spring on the arbor between the pulley and frame next the drill. A radius line should be drawn across the dividing plate, so that the first hole of every circle may coincide. After the first circle is finished the ring must be unrivetted and as many holes cut off as will reduce it to the next number wanted. It will sometimes be better to finish some of the smaller circles before the ring is much reduced; this may be done by skipping one or more holes.

The following are the numbers on my dividing plate; those with this * mark are in the grooves, the others on the plain face.

| Cir. | No. | Subdivisions. |
|---|---|---|
| 1 | 24* | 12, 8, 6, × 4, 3, 2. |
| 2 | 73. | |
| 3 | 365* | 73, × 5. |
| 4 | 36, | 18, 12, 9, 6, × 6, 4, 3, 2. |
| 5 | 360* | 180, 120, 90, 72, 60, 45, 40, 36, 30, 24, 20, × 18, 15, 12, 10, 9, 8, 6, 5, 4, 3, 2. |
| 6 | 30, | 15, 10, 6, × 5, 3, 2. |
| 7 | 300* | 150, 100, 75, 60, 50, 30, 25, 20, × 15, 12, 10, 6, 5, 4, 3, 2. |
| 8 | 86, | 43, × 2. |
| 9 | 276* | 138, 92, 69, 46, 23, × 12, 6, 4, 3, 2. |
| 10 | 82, | 41, × 2. |
| 11 | 132, | 66, 44, 33, 22 12, × 11, 6, 4, 3, 2. |
| 12 | 74, | 37, × 2. |
| 13 | 96* | 48, 32, 24, 16, 12, × 8, 6, 4, 3, 2. |
| 14 | 70, | 35, 14, 10, × 7, 5, 2. |
| 15 | 84* | 42, 28, 21, 14, 12, × 7, 6, 4, 3, 2. |
| 16 | 62, | 31, × 2. |
| 17 | 78* | 39, 26, 13, × 6, 3, 2. |
| 18 | 58, | 29, × 2. |
| 19 | 76* | 38, 19, × 4, 2. |
| 20 | 54, | 27, 18, 9, × 6, 3, 2. |
| 21 | 68* | 34, 17, × 4, 2. |

A list of numbers that may be obtained from this plate showing in which circle they occur.

| No. | Circles. | No. | Cir. |
|---|---|---|---|
| 2 | 1 | 40 | 5 |
| 3 | 1 | 41 | 10 |
| 4 | 1 | 42 | 15 |
| 5 | 3,5,6,7 | 43 | 8 |
| 6 | 1,4,5,6,7 | 44 | 11 |
| 7 | 14,15 | 45 | 5 |
| 8 | 1,5,13 | 46 | 9 |
| 9 | 4,5,20 | 48 | 13 |
| 10 | 5,6,7,14 | 50 | 7 |
| 11 | 11 | 54 | 20 |
| 12 | 1,4,5,7 | 58 | 18 |
| 13 | 17 | 60 | 5,7 |
| 14 | 14,15 | 62 | 16 |
| 15 | 5,6,7 | 66 | 11 |
| 16 | 13 | 68 | 21 |
| 17 | 21 | 69 | 9 |
| 18 | 4,5,20 | 70 | 14 |
| 19 | 19 | 72 | 5 |
| 20 | 5,7 | 73 | 2,3 |
| 21 | 15 | 74 | 12 |
| 22 | 11 | 75 | 7 |
| 23 | 9 | 76 | 19 |
| 24 | 1,5,13 | 78 | 17 |
| 25 | 7 | 82 | 10 |
| 26 | 17 | 84 | 15 |
| 27 | 20 | 86 | 8 |
| 28 | 15 | 90 | 5 |
| 29 | 18 | 92 | 9 |
| 30 | 5,6,7 | 96 | 13 |
| 31 | 16 | 100 | 7 |
| 32 | 13 | 120 | 5 |
| 33 | 11 | 132 | 11 |
| 34 | 21 | 138 | 9 |
| 35 | 14 | 150 | 7 |
| 36 | 4,5 | 180 | 5 |
| 37 | 12 | 276 | 9 |
| 38 | 19 | 300 | 7 |
| 39 | 17 | 360 | 5 |
| | | 365 | 3 |

*Boston Mechanics' Magazine.*

For the Young Mechanic.

## ARCHITECTURE—No. III.

Having briefly noticed in the two preceding essays, the early origin of building, and the improved state of the art as it may be gathered from the early part of Moses' history, it will be proper, before describing the peculiarities of style and workmanship of those ancient nations which have been distinguished for their architectural works, to enumerate some of the essential parts which constitute a building.

The first and most important part, is the foundation. If this be not deep and firm enough to withstand the operations of the weather, and to be secure against common accidents, the superstructure, however costly its materials, or beautiful its design, can be of little value as an edifice, for ornament or for use.

The column is a vertical part of a building, and supports that part of the edifice which is above it.

The wall is generally considered as the lateral continuation of the column, and is intended both for enclosure and for support.

The lintel is a horizontal member of a building, and is placed over an opening in the wall, or extends from the top of one column to the top of another.

The arch is a transverse member of a building, answering the same purpose as the lintel, but vastly exceeding it in strength. The peculiar properties will be noticed hereafter. Abutments are those members of a building on which arches are built, and which sustain all the pressure that is made to bear upon them.

An arcade is a continuation of arches. A vault is the lateral continuation of one arch serving to cover an area or passage, and bearing the same relation to the arch that the wall does to the column.

A roof is the covering to the building. A dome or cupola is a concave covering.

These constitute the essential elementary parts of a building: and the particular forms, arrangements, proportions and ornaments which are given to these, make different styles and orders of architecture.

D. B. H.

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## PATENTS FOR MASSACHUSETTS.

*Granted in August and September, 1832.*

From the Journal of the Franklin Institute.

For a *Machine for Hulling, Cleaning, and Polishing Barley Rice, Broom Corn, &c.;* Theodore F. Strong, and Marcus T. Moody, Northampton, Hampshire county, Massachusetts, August 29.

Two disks are to be made in the form of mill stones, and are to operate in the same way; the upper one is to be of cast iron, to give it weight, but it is to be faced on the lower side with wood. The lower is to be of wood entirely. These disks are to be faced with strong card teeth, set in leather, or other elastic substance, and the grain to be hulled, &c. is supplied as to ordinary mill stones. From between these it passes into a winnowing machine, where the chaff and dirt are blown off, and the clean grain is conducted by a trough through the eye of the upper of another pair of disks similar to the former, but faced with finer materials, as with bristles, hair, or dogfish skin; after which it passes into a second winnowing machine, which completes the operation.

For an improvement in the mode of *Preparing Fomentations used in cases of Sickness;* Timothy L. Jennison, Cambridge, Middlesex county, Massachusetts, August 30.

The main apparatus, or implement to be employed, the patentee denominates a *foveat*, which is to be substituted for the woolen, or other cloths, generally used in fomenting with decoctions of aromatic herbs, or other articles. The foveat is to be made of silk, cotton, linen, or other suitable cloth, and may be about half a yard square. Two pieces may first have lambs-wool batting quilted in between them; a similar piece laid upon this is then to be run, or stitched to it in the manner of the old fashioned housewife, leaving parallel spaces which would admit a round stick of an inch in diameter. The stitching is to be done in double rows, leaving a space of a third of an inch between each of the larger cavities. These large cavities are to be stuffed with the aromatic herbs, &c. by means of a funnel and rod, prepared for the purpose. When thus prepared it is to be dipped into boiling water, and then placed between two boards, which are hinged together at one edge, and is called a compressor; between these it is to be squeezed sufficiently dry, and then applied to its intended purpose. The whole apparatus is claimed as new.

The specification contains remarks upon the mode pursued 'during the past century,' and upon the great superiority of this apparatus and procedure, with particular directions for its use, which we do not think it necessary to copy. We do not dispute the goodness of the contrivance, but its employment will be principally confined to hospitals, and other institutions of a similar character, from which we do not expect, and scarcely wish, that the patentee should realise a fortune. Such establishments as these give freely, and should freely receive.

For an improvement in the mode of *Sizing paper by Machinery;* John Ames, Springfield, Hampden county, Massachusetts, Sept. 1.

For a *Pulp Dresser*, for dressing pulp in the manufacture of paper; John Ames, Springfield, Hampden county, Massachusetts, September 1.

## THE MECHANICAL ARTS.

Next to Agriculture, in point of necessity and usefulness, should be regarded the arts of mechanism. Who is more deservedly entitled to our respect and a rich pecuniary reward, than he who can so control the properties of motion, and calculate velocities, as at once almost to annihilate time and space? than he who is enabled, by the force of the elements themselves, to convert all, that is within reach in nature, to the most advantageous purposes—either to assist man in his enterprises, by supplying his weakness, or to satisfy his wants, or contribute to his convenience?

While our country abounds in the variety of materials necessary to be wrought by the ingenious mechanic into labor-saving machines, and while this supply of materials affords him, of ever so humble means, the required facilities of accomplishing the most surprising works within the compass of human agency, it offers, also, a stimulus to the capitalist to encourage the highest degree of perfection in machinery, for the economy of labor, of which the modifications of the mechanic powers are susceptible.

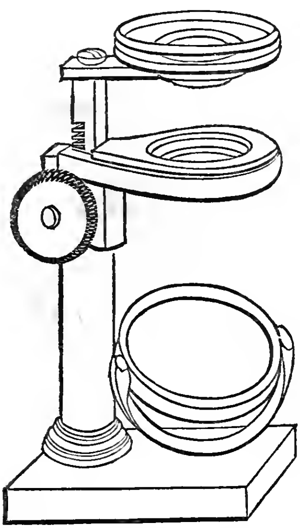
The vast extent of our territory; its cheap and luxuriant soil, inviting by the salubrity and variety of its climate, to all who may choose the honorable calling of husbandry, with a sure promise of a rich reward, renders nugatory the objections of some, that human labor will be out of demand. In this government, at least, while the best of wild lands, at a nominal price, are accessible to all, industrious and ingenious mechanics will never go unrewarded because machinery is too plenty.—And no other country offers the same reciprocal assurance of success in the cardinal pursuits of human industry; the field of our agriculture has no known limits; our commerce, resting on the industry and enterprise of a republican people, looks boldly to countries the most remote; while the motto over the entrance of our manufactories is 'Onward.' Already may it be truly said of the American Mechanist, as it was by the Grecian—Give him but a fulcrum and he will move the world.

With the ardent mechanist, a thorough knowledge of mechanical laws, and a power of referring effects to causes, and vice versa, which always depend upon, and lend to each other, reciprocal aid, is the basis of improvement and discoveries; and a judicious adaptation of materials, and a scientific combination of forces, constitute the perfection of his art.—*Syracuse Argus.*

## A NEW POCKET MICROSCOPE.

In a work lately published in London, called the 'Microscopic Cabinet,' is a description of a new Pocket Microscope, invented by Mr. Pritchard, which we copy from the London Mechanics' Magazine.

Portability is a quality so essential in the opinion of many persons that I have been induced to construct a small instrument for their use, which at the same time should be more consistent in its principles than those in common use, and I believe will be found much more simple and equally useful. In similar instruments before the public, to render them portable, they separate into two or more pieces; this is obviated in my construction by the bar running within a tubular stem. Another objection to the common ones is, that in using high powers the illumination is more feeble than with low powers; but it must be evident that the reverse ought to be obtained, for the more we amplify an object the darker it becomes. In their construction they remove the object further from the light, the higher the magnifying power; in mine the magnifier is brought to the light, the object being stationary. The bar is triangular, and therefore less liable to shake and loosen than square ones. A rough sketch of the microscope with the triangular bar partly drawn out to show the rack is here given.




A are two magnifiers, of which there are four; they fit by a spring into the arm at the top of the bar. These magnifiers are adjusted to the object placed on the stage *b* by the milled head *c* of the pinion, and the light is directed through it by the mirror *d*,

which can be turned about in any direction, and fits into the stand or block *e*. When the bar is lowered and the magnifiers taken out of the arm, the instrument, which is now only two inches and a quarter long, fits into a case (about the size of a snuff-box) one inch and three quarters wide by one inch deep (inside measure); the four magnifiers, packing between the stage and mirrors, do not occupy any extra space.

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## Miscellany.

*The Patent Baker Case.*—This was an action for damages brought by I. Dobson, of Connecticut, against Campbell & Mills of Bangor, for making and vending Double Reflecting Bakers, for which said Dobson had a patent right. It occupied about a day and a half before the U. S. Circuit Court in this place last week, and excited a good deal of interest. The case was managed on the part of the plaintiff by Messrs. Greenleaf, Fessenden and Deblois, and for the defendant by Mr. Sprague.

The arguments of the counsel were able and ingenious, and the charge of Judge Story, as usual, learned and interesting.—The jury after being absent a short time, returned with a verdict of 120 dollars for the plaintiff. And the law in such cases allowing triple damages, the plaintiff recovers 360 dollars and costs.—*Portland Courier, May 7.*

*Jacob Perkins.*—Our countryman is still engaged in his useful labors in England, where he has spent the last fifteen years of his life, exalting, in all his works, the American character for science. Mr. Perkins was a self-taught artist, a native of Newburyport, was originally placed apprentice to a watch maker, and was the first die-sinker in America. At the age of 17, he struck for the Government of Massachusetts, in 1787, the CENT of that State, bearing on one side the *Indian*, and on the reverse, the *Eagle*, thousands of which are now in circulation. The pump box, the nail cutting machine, the invention of engraving on steel, the bank lock, and the steam cannon, fruits of his original mind, will hand his name down to posterity, as one of whom we may justly be proud. Previous to his departure from this country, we passed a day at his establishment in his native town, and was delighted with his extensive works, his communicative disposition, and his admirable simplicity of character. The latter trait was so remarkable, that a child of ten years who sought for scientific information, might ask it of him fearlessly, and be abundantly gratified. We are led to these remarks by observing in a late number of the London Atheneum, the following article, which is the only notice of him that we have seen for a long time:—

*Perkins's Steam Generator.*—In one of our former numbers, we noticed Mr. Perkins's newly discovered system of generating steam, by means of a lining placed within the boiler, thus effecting a continuous circulation of the heated water; the advantages anticipated, were the generating steam with increased rapidity; the preservation of the boiler, and the saving of fuel. In proof of the great probability that the result will fully answer expectations, we are enabled to state, that during the last fourteen weeks, in which period, Mr. Perkins has been engaged in the application of his principle on the Liverpool and Manchester rail-road, one of the locomotive engines employed thereon, having his lining or circulator introduced into its boiler, enduring 360 successive journeys, to and fro, between Liverpool and Manchester, run upwards of 20,000 miles without the slightest appearance of wear and tear, the tubes of the boiler, at the end of the journey, being as free from corrosion as at the first moment of their use, and with a saving of fuel to the extent of 40 tons, when contrasted with the ascertained consumption of another locomotive engine, drawing equal weight. These important results must prove of vital consequence to the great question of railway conveyance, which so much occupies the attention of the public at the present time.—*Boston Eve. Gazette.*

*Sculpture in Ivory.*—Magnus-Berge, one of the most skilful workers in ivory, perfectly understood the art of preserving it. He placed under glass, in beautiful frames, all his works, which, for the most part, were in relief. The numerous master-pieces of this artist which may be seen in the cabinet at Copenhagen, are, from this provision, as white as snow, and it is difficult to believe that they are really ivory; artists then, and those who form collections of this description, will do well to place them constantly under glasses. Cabinets with glass doors are not sufficient to preserve works in ivory, for it is difficult to discover where dust will not penetrate. By placing the sculpture under bell glasses, it derives the double advantage of being preserved from turning yellow, and of being rendered more white than in the first instance, whatever besides may be the disposition to become discolored. Dust is exceedingly injurious to ivory; it fixes itself in the pores, tarnishes its brilliancy, and renders its surface uneven, and is removed with hazard, on account of the fineness of the grain and the lightness of the work.—With respect to antique works in ivory that have become discolored, this disfiguration may be removed, and they may be brought to a pure whiteness by exposing them to the sun under glasses. Antique works in ivory that have become discolored may be brushed with pumice stone calcined and diluted, and while yet wet, placed under glasses. They should be daily exposed to the action of the sun, and be turned from time to time, that they may become equally bleached. The bleaching may be accelerated by frequently repeating the operation just described.—*Repertory of Patent Inventions.*

*Dry Dock.*—We have received from a friend, in reply to some inquiries, a few particulars concerning the U. S. Dry Dock, recently constructed at the Navy Yard, Charlestown, Mass. The Dock, we learn, is 341 feet in length, by 80 in width, and 30 feet deep. It is capable of admitting the largest ship in our navy—viz. the Pennsylvania, the entrance of the dock being 60 feet across, and the width of that ship being 55 feet. The dock is furnished with two setts of gates called turning gates, weighing 50 tons each. Besides these, there is what is denominated the floating gate, which weighs 300 tons; built like a vessel, is 60 feet long, 15 wide, and 30 in height—requiring about 19 feet of water to float it. This is set in a groove outside of the other gates, filled with pig iron, and sunk.

For emptying the dock of water, a powerful hydraulic apparatus is employed, wrought by a steam-engine of 60 horse power. There are 8 lift pumps, each 2 feet 6 inches in diameter, and discharging altogether, at every stroke, 12 hogsheads; there are also 8 chain pumps, 1 foot in diameter. The water is first forced from the dock into wells, then into a large reservoir, whence it runs into the sea. The weight of the steam engine and machinery is about 122 tons.

The floating gate is said to contain timber enough to build a ship of 300 or 400 tons; and some 3 or 4,000 dollars' worth of sheathing and bolt copper have already been used upon it. The turning gates, at high water, sustain a pressure equal to about 800 tons.—*Nantucket Inquirer.*

*India Rubber.*—This valuable product, first made known by La Condamine, in 1736, is the juice of several species of trees growing in South America. It flows from the trees as a milky fluid, which soon hardens upon exposure to the air. Various attempts have been made to transport it to Europe in its fluid state, but without success. Its application to the arts is various, but, until recently, no advantage has been taken of one of its most remarkable properties, its elasticity. Two ingenious chemists of Paris, Messrs. Ratteir and Guibal, by an entirely new solvent and a very delicate process, have succeeded *in spinning it into threads of various sizes*. This is subsequently woven into suspenders, garters, surgical bandages for ruptures, fractured or dislocated limbs, &c.

*Improved Saw.*—Mr. Stephen Ustick, of Philadelphia, has recently obtained letters patent, for a saw of his invention. It consists of a pair of knives or side cutters, which project a very short distance below the points of the common teeth in the saw, so that the saw is moved to and fro, either through a log or across it. The knives or cutters penetrate the wood with great facility, and are followed immediately by the common teeth, which rip out the wood left between the knives with a degree of despatch, which is truly surprising; one man will cut off a log with greater ease, than two men could with a common saw.—*Phil. paper.*

*Polar Table.*—Capt. David Leslie, of New York, has prepared a polar table, by means of which, and the altitude of a polar star, taken at any hour of the night, the latitude may be found in a very simple manner. It is said this will be a valuable acquisition to the navigator, and will be published immediately.—*N. Y. Jour. Commerce.*

*Chronometers.*—For the purpose of encouraging and improving the manufacture of these useful instruments, the British Government offer annually £500 in premiums for such as shall be found to perform best during a twelve month's trial at the Royal Observatory. From an inspection of the monthly reports, issued from that institution, during the trial recently closed, we find that out of the number sent in (sixty-two) the best was declared to be that by Messrs. Molyneux & Sons, No. 1038, which took the first premium—having performed with an accuracy almost incredible—its actual variation from its rate in 12 months being only *sixty-seven hundredths of a second.*

*Science.*—The following practical illustration of science in the common occurrences of life, is from the Genesee Farmer. 'A penknife, by accident, dropped into a well 20 feet deep. A sunbeam from a Mirror, was directed to the bottom, which rendered the knife visible; and a magnet fastened to a pole, brought it up.'

*Sympathy of Motion.*—It has been found, that, in a watchmaker's shop, the time pieces or clocks, connected with the same wall or shelf, have such systematic effect in keeping time, that they stop those which beat in irregular time; and if they are at rest, set a going those which beat accurately.—*Gardiner's Music of Nature.*

The *Axe Factory* of Collins & Co. at Collinsville, Conn. is the most complete and extensive establishment of the kind, in the U. States. They finish from the bar 700 axes per day. This unparalleled rapidity is by means of an ingeniously constructed machine, with which the head and eye of the axe is formed, and after a few strokes of the hammer, is ready to receive the steel, all which is performed in a few seconds.

*Natural Curiosity.*—Two of the greatest curiosities in the world are yet scarcely known to geographers and naturalists. The Tuccoa Falls, South Carolina, are much higher than the Falls of Niagara. The column of water is propelled beautifully over a perpendicular rock, and when the stream is full, it passes over without being broken, and with all the prismatic effect seen at the Niagara. The Table mountain in Pendleton district, S. C. is a precipice of 900 feet. It is now occasionally visited by curious travellers, and sometimes by men of science.

## MECHANICS' EXCHANGE AND READING ROOM.

This establishment which is got up by Mr. Henry Briggs, for a place of general resort for the Mechanics of this city, is just opened for the admission of subscribers. Its advantages to mechanics, are two fold. While it affords the very best accommodations for the transaction of ordinary business, it also furnishes them with all the news, and most of the periodical literature and science of the day. On the Mechanics of this city, depends the success and permanency of this establishment, and permit me to express the desire, that this class of the community may feel sufficient interest in its continuance and prosperity, to induce them to lend their aid in its support. A SUBSCRIBER.

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## ANSWERS.

Messrs. Editors,—I noticed in your last number of the Young Mechanic, the following Questions, viz. 'What occasions the singing (as it is called) of a tea kettle before boiling.' 2d. 'What produces the rumbling noise we hear, when hot iron is plunged into water; or steam let into a cold vessel?' The first, I think, is owing to the production of a small portion of vapor at the heated surface, which rises and is condensed by the cooler atmosphere above; by this condensation, a vacuum is formed, and the water pressing into it, produces the sound. The second, I think, may be attributed to the same cause; as the heated iron is plunged into the water, that which comes in contact with it, is converted into steam, which is condensed by the cold water surrounding it; and a vacuum is formed which the cold water rushes in to fill. This process going on rapidly, produces a louder sound. B D.

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## QUESTION.

Why does rotten wood give light in the dark?

THE

# YOUNG MECHANIC.

JUNE, 1833.

## CHEMISTRY.

[Continued from page 76.]

### THE ATMOSPHERE.

The atmosphere is composed essentially of two gases, oxygen and nitrogen; which have been described in the preceding sections. Water and carbonic acid gas also form a part, and there are doubtless other vapors and gases which enter into its composition, though not in sufficient quantity as to be detected by experiment. The proportions in which the constituents of the atmosphere are united, have been differently stated by different chemists. The following statement will not vary much from the truth.

Nitrogen 75.55; Oxygen 23.32; Water 1.03; Carbonic acid 0.10.

The atmosphere is transparent, colorless, insipid, inodorous, elastic, a bad conductor of heat and electricity. Its specific gravity is 1; it is unity for all other æriform fluids. 100 cubic inches Bar. 30 Therm. 60 weigh 30 1-2 grains.

It is 828 times lighter than water.

The weight of the atmosphere at the level of the sea, is about 15lbs. on the square inch, and is equal to a column of water 34 feet, or a column of mercury 30 inches in height.

From numerous analysis of the air obtained from different parts of the globe, from great distances above its surface, and from the deepest mines, it has been inferred that the proportions of oxygen and nitrogen never vary, except from the operation of limited local causes. It is not improbable, however, that more delicate experiments may in time, show that such is not the fact; but that the proportions of these bodies are variable. The state in which these gases exist, whether of mechanical mixture or chemical

combination, has never been satisfactorily determined. The general opinion is, that they are not chemically united. The other constituents of the atmosphere are known to vary in quantity at different times. At great heights, the quantity of water is very small; caustic potassa on the peak of Teneriffe, 12176 feet above the sea remained dry. Carbonic acid gas has been detected in the air at every height hitherto attained.

The methods adopted for analysing the air, are numerous, and in all, the oxygen is separated from the nitrogen by presenting to it some substance for which it possesses an affinity. Any of the methods enumerated in the article on nitrogen for obtaining that gas, will answer the purpose. We have only to make use of a graduated tube closed at one end, for our experiment, and note the diminution in bulk which has taken place after the whole of the oxygen has been absorbed. The method most generally adopted, and probably the best, consists in igniting hydrogen gas mixed with the air to be examined. 100 measures of oxygen gas require 200 measures of hydrogen for complete combustion. If, therefore, we mix a portion of air with about half its bulk of hydrogen, in a graduated glass tube, and fire the mixture, by an electric spark over water, one third of the diminution in bulk which takes place will be the proportion of oxygen which the mixture contained. By deducting the volume of oxygen gas from the volume of air examined, we obtain the proportion of nitrogen.

For the best method of ascertaining the proportions of carbonic acid and water, which has fallen within my notice, I am indebted to a late memoir by M. Brunner. The apparatus which he describes, to be used for this purpose, consists of a cylindrical glass or metal vessel, having an orifice near the top, in which is inserted a glass tube eleven or twelve inches long, and from three lines to three and a half in diameter, internally, with enlargements near each end. At the bottom of the vessel is a stop-cock.

To use this apparatus for the determination of the quantity of water in the atmosphere, the vessel is filled with water, and the glass tube, lined with amianthus, moistened with sulphuric acid, is inserted into its upper orifice after having been carefully weighed. The stop cock is then opened, and the water suffered to flow slowly into a graduated vessel. When a sufficient quantity of air has been thus exposed to the action of the sulphuric acid, which is known by the quantity of water drawn off, the glass tube is carefully wiped and weighed, and the increased weight shows the proportion of water.

In order to ascertain the proportion of carbonic acid, the same apparatus is made use of, with the exception of the tube, a larger one being necessary for this purpose. A glass tube of the same diameter as the former, and three feet long, having the first two thirds of it filled loosely with hydrate of lime, and the latter with

amianthus moistened with sulphuric acid, is inserted into the cylinder, and air having previously been deprived of its water, is made to pass through it in the same manner as before mentioned. The hydrate of lime will combine with the carbonic acid, and the increased weight of the tube compared with the bulk of water drawn from the vessel will show us the proportion which the air contained. The use of the sulphuric acid in the tube is to combine with the water which is set free from the hydrate of lime by the carbonic acid.

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## GEOMETRY AND ARITHMETIC.

[Continued from page 73.]

### POLYGONS.

Polygon signifies many corners, and is the general name for all rectilineal figures. A regular polygon is one whose sides and angles are all equal. Each polygon has a particular name to denote the number of its sides. Thus a trigon or triangle has 3 sides; a tetragon or square 4; a pentagon 5; a hexagon 6; a heptagon 7; an octagon 8; a nonagon 9; a decagon 10; an undecagon 11; a duodecagon 12, &c.

The area of a regular polygon is found by multiplying the sum of all the sides, (the perimeter,) by half the radius of the inscribed circle; or multiply the radius by half the perimeter.

Fig. 1.

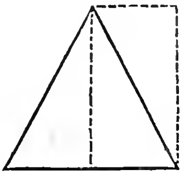
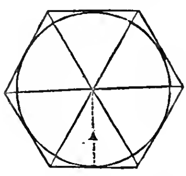


Fig. 2.



Example.—Suppose it be required to find the area of a hexagon, the length of each side being 60 feet, and the radius of the inscribed circle, (or dotted line A fig. 2,) 52 feet. First 3 times 60 equal 180 the length of half the perimeter, which being multiplied by 52, gives 9360 square feet the area.

If lines be drawn from each angle to the centre of the polygon as in figure 2, as many triangles will be formed as there are sides in the polygon; and if the area of one triangle be found, and multiplied by the whole number of triangles, we shall then have the area of the whole polygon. By examining figure 1, it will be seen

that the area of a triangle, is equal to a parallelogram of the same height by half the base; also, that the triangle marked A figure 2, is equal to a parallelogram, whose height is equal to the radius of the inscribed circle, and base equal to half one side of the polygon; that the 6 triangles are equal to 6 such parallelograms; which being placed side by side, would form a parallelogram, whose height is equal to the radius of the inscribed circle, and base equal to half the perimeter of the polygon; hence the rule given above.

### CIRCLE.

A circle is a plane surface, of which the boundary called the circumference is, in all its points, equally distant from a single point called the centre. A straight line, as A C fig. 3, drawn from the centre of a circle to any point of the circumference, is called a radius. A straight line, as A B fig. 3, passing through the centre and terminating at each end in the circumference, is called a diameter.

Fig. 3.

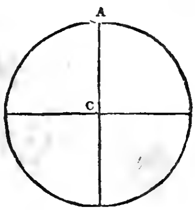
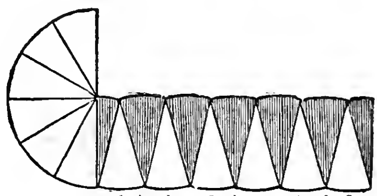



Fig. 4.




Although no part of the circumference of a circle is straight, yet we may without error, regard the circle as a polygon composed of an infinite number of straight sides, it will then be as easy to find the area of a circle, as it is that of a polygon. In fig. 4, is represented half a circle divided into 6 parts, the other half is supposed to be divided in a similar manner, and to be thrown open; which may be done by cutting the radius lines, and having the parts fastened by hinges at a b c d e f. These parts are marked 1 2 3 4 5 6. If the other half of the circle was opened in a similar manner, it would occupy the shaded parts which complete the parallelogram. Two sides of this parallelogram are perfect, being formed of straight lines, the other two are imperfect, being formed of curved lines; but if instead of dividing this circle into 12 parts, it had been divided into 12,000 parts, it would be impossible to tell whether the parallelogram formed in this way, was made up of curved lines or not. In order to be convinced of this truth, let us make a calculation. The circumference of the above circle

is about 3 inches, and 3 inches divided into 12,000 parts would be 4,000 divisions in each inch. How thick a volume would 4,000 leaves, or 8,000 pages make? I find by measuring several books, that there are about 200 leaves in an inch, so that it would take 20 such parts to be equal in length to one thickness of common printing paper. If a line whose length is only one-twentieth of the thickness of such paper could be seen at all, it would be impossible to tell whether it was curved or straight; it would be a mere point; and a succession of such points would form a straight line; and yet 12,000 the proposed division falls far short of infinity. So that it is perfectly correct to say, that the area of a circle is found by multiplying half the diameter by half the circumference. The only difficulty is in finding the ratio or proportion between the diameter and circumference which I will endeavor to explain in my next.

PHILO.

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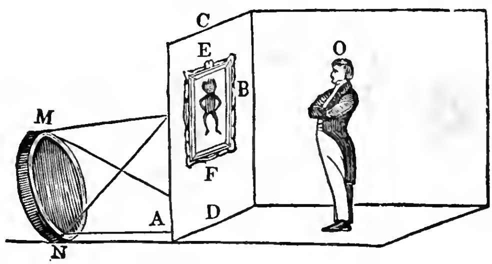
From Brewster's Natural Magic.

## DECEPTIONS WITH THE CONCAVE MIRROR.




The concave mirror is the staple instrument of the magician's cabinet, and must always perform a principal part in all optical combinations. In order to be quite perfect, every concave mirror should have its surface elliptical, so that if any object is placed in one focus of the ellipse, an inverted image of it will be formed in the other focus. This image, to a spectator rightly placed, appears suspended in the air, so that if the mirror and the object are hid from his view, the effect must appear to him almost supernatural.

The method of exhibiting the effect of concave mirrors most advantageously is shown in the cut above, where C D is the partition of a room having in it a square opening E F, the centre of which is about five feet above the floor. This opening might be surrounded with a picture frame, and a painting which exactly filled it might be so connected with a pulley that it might be either slipped

aside, or raised so as to leave the frame empty. A large concave mirror M N is then placed in another apartment, so that when any object is placed at A, a distinct image of it may be formed in the centre of the opening E F. Let us suppose this object to be a plaster cast of any object made as white as possible, and placed in an *inverted* position at A. A strong light should then be thrown upon it by a powerful lamp, the rays of which are prevented from reaching the opening E F. When this is done, a spectator placed at O will see an erect image of the statue at B, the centre of the opening—standing in the air, and differing from the real statue only in being a little larger, while the apparition will be wholly invisible to other spectators placed at a little distance on each side of him.

If the opening E F is filled with smoke rising either from a chafingdish, in which incense is burnt, or made to issue in clouds from some opening below, the image will appear in the middle of the smoke depicted upon it as upon a ground, and capable of being seen by those spectators who could not see the image in the air. The rays of light, in place of proceeding without obstruction to an eye at O, are reflected, as it were, from those minute particles, of which the smoke is composed, in the same manner as a beam of light is rendered more visible by passing through an apartment filled with dust or smoke.

It has long been a favorite experiment to place at A, a white and strongly illuminated human skull, and to exhibit an image of it amid the smoke of a chafingdish at B; but a more terrific effect would be produced, if a small skeleton, suspended by invisible wires, were placed as an object at A. Its image suspended in the air at B, or painted upon smoke, could not fail to astonish the spectator.

The difficulty of placing a living person in an inverted position, as an object at A, has no doubt prevented the optical conjurer from availing himself of so admirable a resource; but this difficulty may be removed, by employing a second concave mirror. This second mirror must be so placed as to reflect towards M N the rays proceeding from an erect living object, and to form an inverted image of this object at A. An erect image of this inverted image will then be formed at B, either suspended in the air or depicted upon a wreath of smoke. This aerial image will exhibit the precise form and colors and movements of the living object, and it will maintain its character as an apparition if any attempt is made by the spectator to grasp its unsubstantial fabric.

## SIMPLIFIED APPLICATION OF STEAM.

At a meeting of the Paris Academy of Arts and Sciences, held on 7th January, a memoir was read, in which M. Pelletan treated of the dynamic effects of a jet of steam, and the means of applying it, in a simple and cheap way, to the purposes of the useful arts. 'A jet of steam,' says the author, 'when thrown into a cylindrical conduit, or into a pipe filled with air, imparts the active power with which it is endued to the column of air, without any other loss than that occasioned by the friction in the conduit, or pipe.'

His detail of the results, which have already ensued from his discovery, are deserving of attentive notice. A jet of steam issuing through an orifice of a milimetre, (·03937 of an inch) under a pressure of five atmospheres, possesses a velocity of five hundred and fifty-nine metres, (1084 3-8 feet,) per second; it consequently moves at the same rate of velocity as a bullet discharged from a gun.

But this enormous velocity is, in its simple form, of no practical benefit, inasmuch as it cannot be converted into a useful agent; when, however, the steam has been enabled to impart motion to a quantity of atmosphere, the velocity, it is true, is diminished, but the mass set in motion is increased; and by this operation, the active power of the jet of steam is susceptible of general application.

The elastic force of steam has hitherto been employed under pressure, by the aid of machines, which are necessarily complicated, and involve a serious loss of power from their bulkiness and friction; but steam, acting immediately by its own power, can be made to effect its objects in machines of so simple a construction, that a steam engine of one man's power, may henceforth be worked by a common fire.

Mr. Pelletan remarks, that the force of steam, so applied, may be brought directly in aid of the machine, and will enable him to double and treble his daily gains, instead of its powers being limited, as hitherto, to filling the coffers of great capitalists at a compound ratio.

The same jet of steam, when applied to the purpose of increasing the draft of furnaces, enables the proprietor to reduce their diameter to two inches, even where a large furnace is in question, to lead the smoke in any direction which may suit him best, and to make use of the whole heat produced. By means of this jet, a vacuum may be effected at will, in any given space, however considerable it may be, and permanently maintained, not only at very small cost, but through the medium of an apparatus of the simplest construction. This process is of ready application wherever evaporation or desiccation are to be effected. Acting upon

a column of air, the jet supplies the simplest and most efficacious mode which can be adopted for creating blasts in forges, furnaces, &c.

It appears that the inventor claims priority in this important discovery, inasmuch as he communicated the properties of the jet in a paper addressed to the academy in 1829, and he is tenacious of the claim in consequence of the later application of the jet in impelling steam carriages in England.—*Athenæum.*

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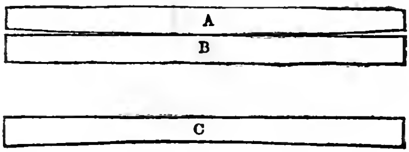
For the Young Mechanic.

## STRAIGHT EDGES.




Among mechanics, there are probably but few that do not appreciate the value of a good straight edge to ascertain the correctness of their work, and I presume that a description of the method practised, and the theory upon which it is based, will be interesting. There are doubtless many, that like myself have thought it absurd, even when told seriously by good practical workmen that it was impossible to make *one* straight edge, without making *three*, or that one plate of an air pump could not be ground flat, unless three were ground at the same time.

When I inquired the reason of this, I could get no other explanation from my informant, than that such was the fact. Although at that time I considered the idea ridiculous, I have since discovered that my friend was perfectly correct, and had he been able to have stated the cause or theory, I feel assured I should have been convinced.

I am aware in the formation of straight edges, that the size must depend much upon the work to which it is to be applied, yet some regard to the form and dimensions are advisable, as there is a certain proportion more suitable than any other. An eminent English writer* observes upon this subject, that in England they are made of thin bars of steel about one eighth of an inch thick, two inches broad, and should not exceed three feet in length, as they will otherwise be liable to bend.

Three such pieces should be prepared by planishing, and one

* Dr. Birkbeck.

edge of each made as straight as possible by the common means of filing and planing, when they are perfected by grinding them mutually with each other, fine emery and oil being added to assist the operation. They are finally to be finished with crocus martus, or a species of loam well washed to separate it from any coarse, silecious particles.

By referring to the cut at the head of our article, we will attempt to show the necessity of making three, to produce one perfect straight edge, and also of repeatedly changing them at proper intervals, until each edge is correct. Let A and B represent two steel bars prepared for grinding; let us then suppose the edge of A to be slightly convex, and that of B slightly concave, or nearly straight, then by grinding A and B together, the two edges will meet, but will not be straight, because the convex bar A, has ground the lower bar B more concave, and although the two edges come in close contact, yet the form is unchanged, and however long the grinding should be continued, the object could never be attained.

But if we now take a third bar C, the edge of which may be either concave, or convex; if concave, and we grind A and C together, the edges of B and C will then be similar, and if placed against one another, the difference will be doubled and can readily be perceived; these two are then to be ground together, and thus, the three edges being alternately and reciprocally ground together, they will mutually cut down and destroy each others' imperfections, and ultimately a perfect straight edge will be produced on all the three.

The same theory applies to the levelling of air pump plates, and other flat surfaces in machinery where great nicety is required, and the best method of producing them is, to proceed in the manner above described. J. M. W.

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From the Philadelphia Gazette.

## INCOMBUSTIBLE ARCHITECTURE.

An Important Discovery.—C. S. Rafinesque of Philadelphia, 'Professor of Many Sciences, Architect, Draftsman, &c.,' has announced to the public, the discovery, by himself of a new mode of erecting buildings of all kinds, so as to render them entirely incombustible. He denominates this discovery by the term Incombustible Architecture, and alleges the following as the advantages of the new style, all which he offers to warrant, viz:

1. Buildings will be fire proof. 2. They cannot be set on fire on purpose. 3. They cannot catch fire from neighbors. 4. They will last longer. 5. They can be warmed in winter at 1-3d the

usual cost. 6. They will be insured at a mere trifle. 7. They will be warmer in winter. 8. They will be cooler in summer. 9. They will require no expense of fire engines and firemen. 10. They will save the lives of 100,000 persons doomed to be burnt alive. 11. They will save 100,000,000 of dollars of property doomed to be burnt. 12. They will look neater and be more convenient inside with more space, &c. &c.

These unquestionably are important considerations, and the Professor speaks most certainly of his ability to perform all he promises. The *modus operandi*, of this new style, he wisely and discreetly keeps to himself, but with magnificent liberality he offers to divulge the secret to any architect for the sum of 1000 dollars. Or if any demur at this price, he declares he will himself undertake the erection of any edifice, and receive for payment the saving in fuel and insurance, and in the expense of the building—it being part of the Professor's plan to build houses of this kind at a much cheaper rate than in the ordinary way. Certainly we bespeak much attention to the Professor's declaration.

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## ELECTRICAL MACHINES.

By R. Hare, M. D., Professor of Chemistry in the University of Pennsylvania.

Sometime since, in looking over a volume of Cavallo's Electricity, I was surprised to observe that in order to give the greater efficacy to an electric machine, he advises that the cushion, or negative poles, should be made to communicate advantageously with the earth. As the means of accomplishing this object he suggests a conducting communication 'with moist ground, with a piece of water, or with the iron work of the water pump.'

It appears from the following passage in Turner's Chemistry, a work generally of great merit, that the erroneous impression which gave rise to these suggestions, has been adopted by a more modern author. We find, page 77, American edition, the following allegation:

'The electricity which is so freely and unceasingly evolved during the action of a good electrical machine, is derived from the great reservoir of electricity, the earth. This is obvious from the fact that if the whole apparatus is insulated, the evolution of electricity immediately ceases; but the supply is as instantly restored, when the requisite communication is made with the ground. In the state of complete insulation, the glass and prime conductor are positive as usual, and the rubber is negatively excited; but as the electricity then developed is derived solely from the machine itself, its quantity is exceedingly small. When the machine is used, therefore, the rubber is made to communicate with the earth. As soon as friction is begun, the glass becomes positive and the rubber negative; but as the latter communicates with the ground it instantly recovers the electricity which it had lost, and thus continues to supply the glass with an uninterrupted current. If the rubber is insulated, and the prime conductor communicates with the ground, the electricity of the former, and all conductors connected with it, is carried away into the earth, and they are negatively electrified.'

I conceive that the earth has never, of *necessity*, any association with the phenomena of the electric machine; of which the power is evidently dependent on the efficacy of the electric, in transferring the fluid from the negative to the positive conductor. When the machine is made to act and conductors are both insulated, they are brought into states of excitement as opposite as the power of the machine is, at the time, competent to produce. If, under these circumstances, with one end of a metallic rod, (terminating in a metallic ball, or other suitable enlargement, and held by means of an insulating handle,) we touch the negative conductor, while the ball is approximated to the positive conductor, sparks at least as long, and as frequent, will be obtained, as when the negative conductor, or cushion, has the best possible communication with the earth. I conceive that any metallic surface or surfaces, duly connected with either conductor, must become virtually a part of that conductor, and partake of its excitement. In this predicament, whilst receiving a charge, are the coatings of a Leyden jar, or an association of such jars in a battery. The effect of the machine is merely to transfer the fluid from one surface to another. After the conductors, and any jar, or battery, associated with them are charged, there is no more electricity in the surfaces than before; since whatever one has gained, the other has lost.

If the impressions of the learned professor were correct, how could a battery or a jar be charged, where both it and the machine are insulated from the earth? Yet experience shows that it is under these circumstances that a charge is most easily imparted. When the conductors are in a state of excitement, and both insulated, the one will of course be as much below that of the surrounding neutral medium, and of the great reservoir, as the other is above that standard. When we connect either conductor with the earth, it returns of course to the neutral state of the earth; but the difference between the excitement of the conductors is sustained by the power of the machine to the same extent as before; hence the length and frequency of the sparks will not be found to be sensibly altered. It follows that when either of the conductors is made neutral by connexion with the earth, that the other will have its excitement as much above or below neutrality, as the sum of the difference between each of the two conductors and the terrestrial neutrality when both are insulated. Thus supposing that when insulated, the one conductor is, relatively to terrestrial electricity, minus ten, and that the positive conductor is plus ten; when the negative conductor alone is uninsulated, the positive will be plus twenty, when the latter is alone uninsulated the former will be minus twenty.

It seems to be a common, though as I believe an erroneous idea, that a spark changes its character with the conductor from which

it appears to be taken; so that when produced by presenting a body to the positive conductor, it is considered as positive, and as negative when produced with the negative conductor in like manner.

I have already observed that any conducting surface in connexion with either conductor, must act as a part of that conductor. Approximating to the negative conductor, a body (a ball, for instance,) while in communication with the positive conductor, is really enlarging or elongating the surface of the latter, so that when the spark passes, it must still be from the positive to the negative pole: and vice versa, elongating the surfaces associated with the negative conductor, till sufficiently near the positive conductor to receive a spark, does not alter the character of the phenomenon. In each case, according to the theory of one fluid, a current passes from the positive to the negative pole, and according to the doctrine of two fluids, two currents pass each other.

The cause of the difference observed in the sparks in the two cases is, that they are usually received from a small knob upon a big ball, or the hand; or some other body comparatively large.

Whenever the fluid is contracted into a small jet on the positive side, its projectile power is increased; while under the opposite circumstances, its projectile force is lessened. This is the sole cause of the long forked erratic form, of what is called the positive spark; and the short stubbed appearance of what is called the negative spark. The whole difference may be effected in whatever situation the sparks may be taken, by causing a large and a small ball to exchange sides. When the surface on the positive side is so small as to condense the electric matter before it jumps, the projectile force is greater, and, as in the case of the jet pipe in hydraulics, there is a medium size at which the greatest projectile power is obtained. When the emitting surface is too large, the projectile force is lessened, and the spark consequently made shorter.

The following passage in Cavallo's Electricity is that alluded to above. See vol. 1st, page 184: London, 1786.

'Sometimes the machine will not work well because the rubber is not sufficiently supplied with electric fluid; which happens when the table upon which the machine stands, and with which the chain of the rubber is connected, is very dry, and consequently in a bad conducting state. Even the floor and the walls of the room are in very dry weather bad conductors, and they cannot supply the rubber sufficiently. In this case the best expedient is to connect the chain of the rubber, by means of a long wire, with some moist ground, a piece of water, or with the iron work of the water pump, by which means the rubber will be supplied with as much electric fluid as is required.'

The learned author is, I think, altogether wrong in imagining that the dryness of adjacent bodies can have any ill effect. In common with the great mass of electricians of this time, as well as his contemporaries, he has overlooked a real cause of deterio-

ration. I allude to the imperfect conducting power of cushions, made as they are usually, of silk, or leather stuffed with hair, or other nonconducting substances. The desiccation of the cushion and other parts of the rubber, may counteract the benefit otherwise produced by any increase of aridity in the surrounding medium.

By stuffing the cushions with the elastic iron shreds scraped off from weaver's reeds in manufacturing them, and making a communication between the shreds and the steel spring supporting the cushion and attached to the negative conductor, I have seen the sparks yielded by a machine more than trebled in length and frequency.

As a coating for the cushion, upon the whole, I find the aurum musivum, more efficacious than the amalgam usually employed, which is apt to adhere to the glass, and promote the passage of sparks from the cushion to the collecting points of the positive conductor. I question if the amalgam does not owe its efficacy to its conducting power, which tends to compensate the absence of this property in the cushion.

In speaking of experiments performed by means of electrical machines, the poles and conductors may in general be treated as synonymous; yet strictly the poles are those parts of the conductors, or conducting surfaces in connexion with them, between which the discharge takes place; so that when insulated metallic rods, however long, are each at one end in contact with the conductors of the machine, the poles may be at the other ends of the rods. This view of the subject is generally recognised in the case of Voltaic series, which not being terminated by conductors, in the technical sense used in speaking of the machine, gives rise, in this respect, to less cause of misapprehension.

I conceive it an error to suppose that the association of a large conductor with a machine contributes to the intensity of the sparks. It appears to me to render the sparks shorter, and less frequent, though otherwise larger.

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## PATENTS FOR MASSACHUSETTS.

*Granted in October,* 1832.

From the Journal of the Franklin Institute.

For an improvement in the *Machinery for manufacturing Paper;* patented by John Ames, Springfield, Massachusetts, May 14, 1822. Patent surrendered, cancelled, and reissued under an amended specification, October 25, 1832.

In the original specification, a very general and imperfect description of the machinery was given, without the slightest intima-

tion of what was considered by the patentee as his improvement. The machine is of the cylinder kind first invented in France, and which has since undergone many improvements there, as well as in England and in this country; and by the amended specification it appears that the invention of the patentee consisted in the particular way in which he constructed his cylinder, his claims being in the following words,—'What I claim as new, and as my invention, is the construction and use of the peculiar kind of cylinder above described, and the several parts thereof in combination for the purpose aforesaid.'

This apparatus having been long in use, and well known, we do not consider it as necessary to describe the cylinder as it is constructed by Mr. Ames.

For an improvement in *Cutting Pliers;* Russell Curtis, Springfield, Hampden county, Massachusetts, October 25.

The improvement here claimed consists in the insertion of steel cutting dies, in dovetail grooves prepared for the purpose, instead of making the cutting part in one piece with the pliers. Different forms of pliers, and places for the insertion of the dies are referred to in the description, but the foregoing is the essential point of the invention. Although a simple, we think it a very good thing; in point of principle it is not new, but it may be so in its application to pliers.

For *Machinery for Hammering or hardening Taps, or Soles, for Boots and Shoes;* Stillman Knowlton, Athol, Worcester county, Massachusetts, October 25.

Instead of hammering the leather, it is to be passed between two rollers, one placed above the other like the rollers of a flatting mill; the rollers are not to be cylindrical, but one of them, the upper, is to be concave, and the other convex, so that the leather, when rolled, shall be in a proper shape for the last. The gudgeons of the lower roller, raise by a moveable lever, and it is forced against the upper roller by placing the foot upon a treadle; a spiral spring relieving it when the foot is removed. The operator places one end of the leather between the rollers, puts his foot on the treadle, and then, with his right hand, turns a crank, which by means of wheels and pinions, gives motion to the rollers. The leather, it is observed, may be hardened to any degree; according to the will of the operator, and one man can perform as much work as ten in the usual way.

The claim is to 'the position of the rollers, the one being placed above the other, and the application of the spiral spring.' If this machine is new, and operates as well as it is said to do, and we see no reason why it should not, we think the claim most palpably defective. The rollers might, with equal advantage, be placed side by side, and the effect of the spiral spring rendered

unnecessary by other contrivances. The claim, it seems to us, should have been to the rolling of leather for soles, between rollers of the kind described, instead of hammering them, as has been heretofore done; one of the rollers being so fixed as to admit of its being forced against the other by means of levers, or other suitable contrivances.

For *Fireplaces for the burning of Anthracite or other Fuel;* Artemus Turrell, Boston, Massachusetts, October 25.

The grate upon which the fuel is to be burnt, is on a level with the hearth, there being an air flue from below, or from without the room, leading to it. A sort of forked poker, which the patentee calls a picker, rises through the bars of the grate, to disturb the fire, and is to be moved by a lever. These are the two things claimed, and they do not, as represented, induce us to break the tenth commandment.

For a *Rack Wrench*, for turning the nuts of screws; Henry King, Springfield, Hampden county, Massachusetts, October 25.

This is intended as a substitute for the screw wrench, to which we think it superior in all respects. The main bar of the wrench is square, and the upper side of it is notched across, to receive a click. The sliding cheek of the wrench is supported by a piece projecting from the back of it which rests upon the bar. This carries a spring and click, and when the wrench is to be used, all that is necessary, is to push the sliding piece against the nut, the spring forcing the click into one of the notches on the bar, and thus holding it in its proper place.

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## Miscellany.

*Stocking Knitter.*—Mr. M'Mullen, of Birmingham, Huntington county, Pennsylvania, has constructed this machine; it is small, occupies but a little space and requires about as much power as a common hand organ to turn its crank, except when a stitch is dropped or one required to be added. The machine can do the work of six expert knitters. The cost, about fifteen dollars, including the patent right. It is adapted for knitting wool, but may be used for cotton, silk or thread.

*Anthracite Coal for Steam.*—The Albany Argus states that Dr. Nott has successfully applied Anthracite coal to steam boilers in the furnace of Messrs. H. Nott & Co. of that city. Extensive machinery is moved by steam produced by a flame which arises from hard coal thirty or forty feet from the furnace in which it is burnt.

*Reach of Voice—Extent of Churches.*—The Romanists built large churches; it was enough if they heard the murmur of the mass, and saw the elevation of the host; but ours are to be fitted for auditories. I can hardly think it practicable to make a single room so capacious with pews and galleries, as to hold above 2000 persons, all to hear the service and see the preacher. The position of the pulpit requires a consideration; a moderate voice may be heard fifty feet distant before the preacher, thirty feet on each side, and twenty behind; and not this unless the pronunciation be distinct and equal, without dropping the voice at the end of the sentence. A Frenchman is heard farther than an English preacher, because he raises his voice at the last words of a sentence, like the Roman orators. A church should therefore be ninety feet long, sixty broad, besides a chancel at one end, a belfry and portico at the other.—*Wren—Lives of Architects.*

*Dr. Franklin.*—The leading property of Dr. Franklin's mind—great as it was—the faculty, which made him remarkable, and set him apart from other men;—the generator, in truth, of all his power—was GOOD SENSE—only plain, good sense—nothing more. He was not a man of genius; there was no brilliancy about him, little or no fervor; nothing like poetry, or eloquence; and yet—by the sole, untiring, continual operation of this humble, unpretending quality of the mind, he came to do more in the world of science; more, in council; more, in the revolution of empires, (uneducated—or self-educated as he was,) than five hundred others might have done; each with more genius, more fervor, more eloquence, and more brilliancy.—*Blackwood's (English) Magazine.*

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## QUESTION.

WHAT is the weight sustained by a pile, when a cast iron hammer of one ton weight is let fall from a perpendicular height of 39 feet; with nothing to impede its force?

If any of your correspondents will answer the above question, as it is a dispute among practical mechanics, they will oblige A SUBSCRIBER.

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## TO CORRESPONDENTS.

E. G. is received, but is necessarily deferred till our next number.

We trust our various correspondents will bear us in mind during the warm months.

THE

# YOUNG MECHANIC.

JULY, 1833.

For the Young Mechanic.

## CHEMISTRY.

### HYDROGEN.

*Inflamable air.* Phlogiston, of some writers.

The existence of hydrogen was known at a very early period; but the first proof of its being a distinct gas was derived from the experiments of McCavendish in the year 1776. It is largely diffused throughout nature in combination with other bodies. It gives the power of burning with flame to all those substances used for the economical production of heat and light. It forms a part of animal and vegetable bodies, water, mineral coal, and other important compounds which will be mentioned hereafter.

Hydrogen gas is colorless, transparent, elastic, tasteless, inodorous. As usually prepared, it possesses a slightly fœted odor, supposed by some to be owing to a volatile oil formed by the union of hydrogen with carbon, from the metal, by which it is prepared, by others to arsenical particles obtained from the zinc. It is an element in relation to our knowledge. It is the lightest form of matter with which we are acquainted; its sp. gr. is 0.0694, air being 1; 100 cub. in. at medium temperature and pressure weigh 2.116 gr. Its combining proportion is represented by 1.

100 cub. in. water, freed from air, absorb 1 1-2 inches of hydrogen at the ordinary pressure; by strong pressure it may be made to take up one third of its volume.

It refracts light more powerfully than any other gas.

It is electro-positive.

The specific heat of hydrogen in comparison with an equal weight of air, is as 12.3401 to 10000, as estimated by M. Berard and De la Roche. It is inflammable: is not a supporter of combustion. A lighted taper inserted into a jar containing hydrogen inflames the gas, but is itself extinguished. The temperature at which it inflames, according to Dr. Thomson, is 1000° F. When pure, the flame is nearly colorless. If a glass tube open at both ends be held over a jet of hydrogen while burning, musical tones will be produced; varying with the length and diameter of the tube. The sound is supposed to be occasioned by repeated explosions, produced by a union of the hydrogen with the oxygen of the atmosphere in the tube. Similar sounds may be produced by some other gases.

The most common process made use of for obtaining hydrogen gas is to decompose water by means of zinc and sulphuric acid. For this purpose, place in a glass or lead retort, 1 part of zinc or iron in fragments, and 6 parts of water; 2 parts of sulphuric or muriatic acid must be added in successive portions as may be required. The first portion of gas generated should be suffered to escape as it forms an explosive mixture with atmospheric air.

During this process, the oxygen of the water combines with the zinc forming oxide of zinc which unites with the acid forming sulphate or muriate of zinc, while the hydrogen of the water is set free. How the acid operates in this case to effect decomposition of the water, we are ignorant. It is a case of what has been termed disposing affinity; but we cannot suppose that the affinity which the acid has for the oxide can operate to produce the oxide. Murray suggests that the acid, in this case, exerts a simultaneous attraction towards the oxygen of the water and the metal. We have no evidence to support this suggestion.* 1 ounce of iron will yield 782 cubic inches hydrogen gas; 1 oz. zinc yields 676 cubic inches.

Hydrogen, as usually prepared, contains carbonic acid, and sulphureted hydrogen; from which it may be freed by introducing lime or caustic potassa. A little carburetted hydrogen is sometimes present; to prevent this, the zinc should be previously distilled.

Hydrogen gas is used for filling balloons; and owing to its extreme lightness, it is better adapted for this purpose than any other substance. It is used also for the reduction of metallic oxides on the surface of ribbons, &c. for ornamental purposes. For this purpose, the ribbon is stamped with a solution of the metal in an acid and exposed to a current of hydrogen gas. It is a useful agent in the analysis of gaseous mixture, and in combination with oxygen, it is used to obtain an intense heat. By directing the flame of this mixture upon lime an intense light is produced; in a communication to the Royal Society of London on the subject of light-houses, Lieutenant Drummond states that a ball of lime 3-8th of an inch in diameter treated in this manner afforded a light equal to thirteen argand lamps.

* For other processes for obtaining hydrogen, see analysis of water in the next article

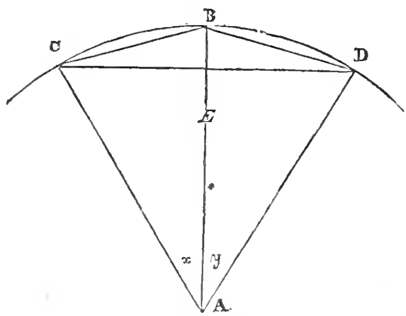
## GEOMETRY AND ARITHMETIC.

[Continued from page 89.]

### CIRCLE.

To calculate the ratio of the *diameter* to the circumference, mathematicians have compared the circumference of a circle to the sum of all the sides of a regular inscribed polygon of a great number of sides; for it has been shown (page 88) that the circumference of a circle differs very little from the sum of all the sides of such a polygon.

For this purpose they took a regular inscribed *hexagon*, each of the sides of which is equal to the radius of the circumscribed circle. For the sake of convenience they supposed the diameter of the circle equal to unity; the radius, and therefore the side of a regular inscribed hexagon is then $\frac{1}{2}$, and the sum of all the sides (6 times 1-2) equal to 3. This is the first approximation to the circumference of a circle.




From the side of a regular inscribed hexagon, it is easy to find that of a regular inscribed polygon of 12 sides. Supposing, for instance, the chord CD to be the side of a regular inscribed hexagon, by bisecting the arc CD in B, the chords BC, BD, will be two sides of a regular inscribed polygon of 12 sides, the length of which can easily be calculated when the chord CD and the radius AC are once known. For the radius AB which bisects the arc CD, makes the angles $x$ and $y$, which are measured by the arcs DB, BC, equal to each other; and therefore AE is perpendicular to the chord DC, and bisects it in E.

Now the radius AC and EC (half of CD), being known, the hypothenuse and one of the sides of the right-angled triangle AEC are given; whence it is easy to find the other side AE, by the rule given page 72. Thus if the radius is supposed to be 1-2, the side CB of the inscribed hexagon is also equal to 1-2; and EC (half of CD) is $\frac{1}{4}$. Taking the square of 1-4 from that of 1-2, and ex-

tracting the square root of the remainder, we obtain the length of the side AE, which, substracted from the radius AB, leaves the length of BE. Now we can find the side BC, in the right-angled triangle BCE, by extracting the square root of the *sum* of the squares of BE and EC (see page 72); and one of the sides of the regular inscribed polygon of 12 sides being once determined, we need only multiply it by 12, in order to obtain the sum of *all* its sides, which is the *second* approximation to the circumference of the circle. In precisely the same manner can the sides, and consequently also the *sum* of all the sides of a regular inscribed polygon of 24 sides be obtained, when those of a regular inscribed polygon of 12 sides are once known; which is the third approximation to the circumference. Thus we might go on finding the sum of all the sides of a regular inscribed polygon of 48, 96, 192, &c. sides, until the inscribed polygon should consist of several thousand sides: the sum of all the sides would then differ so little from the circumference of the circle, that, without perceptible error, we might take the one for the other.

In this manner the approximation to the circumference of the circle has been carried further than is ever required in the minutest and most accurate mathematical calculations.

The beginning of this extremely tedious calculation gives the following results.

| Parts of the circumference. | Sides of the inscribed polygon. | Sum of all the sides of the inscribed polygon. |
|---|---|---|
| 6 | 0,5 | 3 |
| 12 | 0,258819 | 3,105228 |
| 24 | 0,130526 | 3,132628 |
| 48 | 0,065403 | 3,139348 |
| 96 | 0,032719 | 3,141033 |
| 192 | 0,016361 | 3,141446 |

It is not necessary to carry this calculation any further, since analysis furnishes us with means to obtain the same results in a much easier manner.

The substance of the preceding is taken from Grund's Plane Geometry.

Various attempts have been made by different persons from the time of Archimedes to the present, to find the ratio of the circumference of a circle to the diameter; and some of them have extended it to more than 100 places of decimals; but the process is very tedious, and the further extension of it useless, as seven places of decimals is sufficient for any practicable purpose; in fact, the common factor 3.1416 consisting of four decimal places, is the one commonly used by mechanics, by which many problems relative to the circle may be solved; these I shall attempt in my next.

PHILO.

## KIRK'S MACHINE.

**Specification of a patent for an improvement in the method of Sawing Marble, and other stone, and cutting or working mouldings, or groovings, thereon, and polishing the same. Granted to Isaac D. Kirk, city of Philadelphia; first issued July 3, 1832. Patent surrendered, and reissued on an amended specification, December 28, 1832.**

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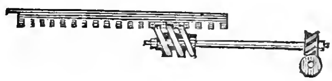

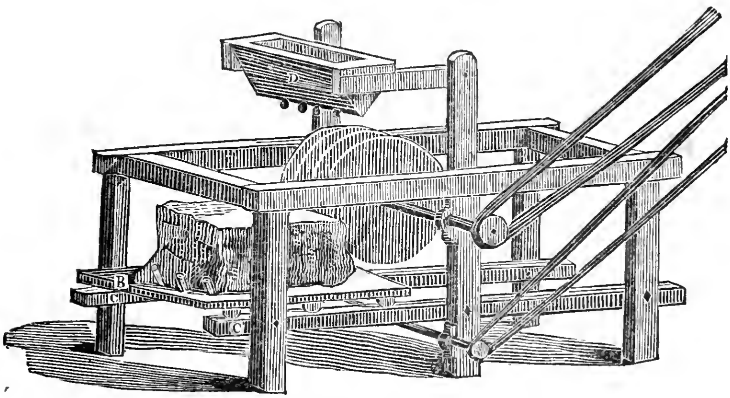


A. The saws, or the moulding cylinder of soft cast iron.
B. Carriage to support and carry forward the marble, or stone.
C C. Rails on which the carriage travels.
D. Hopper for sand and water.
E. Apparatus for advancing the carriage.

To all to whom these presents shall come, be it known, that I, Isaac D. Kirk, of the city of Philadelphia, and State of Pennsylvania, have invented a new and useful improvement in the method of sawing marble and other stone, and cutting, or working, mouldings, or groovings, thereon, and polishing the same; the sawing being performed by means of an improved revolving, circular, metallic plate, smooth, or without teeth, upon the face, or edge, operating by friction with sand and water upon the material to be cut; and the moulding, or grooving, and polishing, being effected by means of the improved revolving moulding and polishing cylinder, or wheel, operating in cutting mouldings by friction with sand and water upon the surface to be wrought; and in polishing by

friction, in like manner, with putty, buff, pumise-stone, or some other suitable material; viz. one or more circular metallic plates, smooth or not serrated upon the face, or cutting edge, (copper, or soft iron are deemed preferable,) are securely fixed, vertically, upon a horizontal shaft, or spindle, of iron, of any required dimensions, passing through the centre of the plate, or plates, and supported at each end by a proper frame of wood, or of cast iron, upon which the shaft works. On one end of the shaft is a cog wheel to connect it to the moving power.

Where two or more plates are used on the same shaft, they are secured at the proper distance from, and parallel, to each other, by circular metallic bands of a thickness adapted to the intended thickness of the slab, or slabs, to be cut; which bands are fitted upon and around the shaft between the plates, or saws. Under the shaft, at the distance of a little more than the radius of the plates, or saws, is a carriage on friction rollers, or wheels, resting on a permanent rail-way, to support and carry forward the stone, or marble, to the plates, or saws; it is moved either by a rack and pinion, or by weights and pulleys. Over the saws is fixed a hopper, filled with sand and water, which is carried by a conductor leading from an apeture in its bottom, to the saws at the point of their contact with the stone or marble. The plates, or saws, may be made of any required dimensions, and must be wrought to a uniform thickness throughout, with the cutting edge smooth, or not serrated, and either rounded, beveled or flat. The improved moulding and polishing cylinder, or wheel, is of any metal, (cast iron is preferable for moulding, and some of the softer metals, and wood, for polishing,) and of any requisite dimensions, having the converse of the intended moulding, or grooving, either cast or turned upon its surface, or periphery, by means of which any series of mouldings, or groovings, can be wrought on a surface of marble, or stone, at one operation, and in like manner be polished. It is fixed on a horizontal shaft passing through its axis, which is turned by a cog wheel connecting it to the power, and operates on the material to be wrought, by revolving vertically against its surface in contact with sand and water in cutting mouldings, and in contact with pumice-stone, buff, putty, or some other suitable material in polishing. A cylinder, having a regular smooth surface, is used in like manner for flatting, and for polishing a plain surface. The marble, or stone, is carried forward, and under the moulding and polishing cylinders by a mechanical arrangement similar to that before described.

The polishing cylinder is similar in form to the above, and used in like manner with polishing powder, as putty, buff, &c. instead of sand, and is made of wood, or some of the softer metals.

The improvement claimed by said Isaac D. Kirk, consists in the sawing of marble, or other stone, by means of a revolving, circular, metallic plate, smooth, or not serrated, on the face, or edge,

and applied with sand and water, as is done with the straight saw; and also in making, or forming upon the surface, or periphery, of a metallic, or wooden cylinder, or wheel, the converse of the intended moulding, or grooving; by means of which, a series of mouldings, or grooves, can be wrought on a surface of marble, or stone, at one operation, with sand and water. And in like manner, polished with putty, buff, pumice-stone, or other polishing material.—[*Journal Franklin Institute.* ISAAC D. KIRK.

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For the Young Mechanic.

## ARCHITECTURE.—No. IV.

AMONG the nations of antiquity, Egypt, India, and Persia, were distinguished for the beauty and grandeur of their architecture.—But it is still a matter of controversy, to which of these nations belongs the credit of making the first improvements, in the art of building. Without, however, touching the question of priority (which probably never will, nor can be settled) we will briefly notice the peculiarities in the architecture of each of these three ancient nations. And first of Egypt. The ancient structures of Egypt, were built of stone and were of three different forms. First, the simple pyramid. Second, apartments enclosed by sculptured walls, with flat roofs, supported by rows of columns, and connected by open porticos. And third, caverns, grottos, or tombs.—Which of these forms of building, was first practiced by the Egyptians, is a question upon which much has been written; but as there is no historical evidence, which throws the least light on this inquiry, the matter must always remain unsettled.

The peculiarities which belong to the Egyptian style, are the following. The walls of their edifices were universally of immense thickness, and sloping on the outside. The roofs were flat and without pediments. Columns of large diameter, short, and placed very near together. Ornaments in abundance; consisting of hieroglyphics, images of animals and fabulous deities. These covered their walls, and were sometimes carved on their columns, and entablatures. But generally the entablature consisted of vertical flutings, with a winged globe in the centre.

Gigantic pyramids, colossal statues and towering obelisks, belong to Egyptian architecture. The astonishing magnitude and grandeur of some of the ancient edifices, exceeds all description. As a specimen take Kamack. This was the greatest edifice in Egypt, and was dedicated to Priapus. The court was 110 paces in length, and the same in breadth. Two ranges of six columns conduct to a portico of 136 columns. The two middle ranges of these, are 11 feet diameter. The others are 7; the length of this vestibule is 78 paces, the breadth 25: it leads into a court where there

are four obelisks, and 12 colossal figures. Two other courts conduct to what is supposed the apartments of the Kings. Adjacent to the great palace, are many other extensive buildings, connected with it by avenues of sphinxes, lions and rams.

The most perfectly executed of the Egyptian temples is that of Tentyra. The front of the building is 72 paces in breadth, 145 in depth, and 70 feet in height. A most elegant door way conducts into a portico 60 paces by 30, supported by 24 columns, 7 feet diameter, and 35 in height. The hall which succeeds the portico, is 24 paces square. It is supported by 6 columns, whose capitals are each composed of four figures of the head of Isis with the ears of a cat; the second hall is 24 paces by 10; the third is of the same dimensions. The apartment which succeeds the last hall is 24 paces by 6, and is insulated by a space on each side of it; this was probably the sanctuary. In the second hall there were two stair cases, which led to the terrace or roof.

All the edifices of Egypt, were of amazing solidity. This characterestic was owing to the prevailing belief that the souls of the dead would return again to the earth, after a certain period, and inhabit the same bodies which they had left, and the buildings.

D. B. H.

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## PATENTS FOR MASSACHUSETTS.

*Granted in November, 1832.*

From the Journal of the Franklin Institute.

For an improvement in the *Common Spindle for Spinning Cotton;* Nathaniel Rider, Dudley, Worcester county, Massachusetts, November 3.

The common live spindle is to be surrounded by a tube along that part of it upon which the bobbin is usually placed; this tube is to receive the bobbin, which then occupies the same part, in relationship to the flyer and whirl, which it would were the tube not there; the bobbin is also made to rise and fall on the tube as it would on the naked spindle. The advantage said to result from this is, the creation of a friction which gives an easier and more steady draft, especially when the motion is rapid. The washer, it is stated, should be much smaller than that now in use on the live spindle. The claim is to the particular form of the tube, and the metallic washer. The drawing which accompanies the specification is without written references, but those acquainted with the subject, will perceive the nature of the thing claimed.

For an improved mode of *Moving the Rudders of Ships* in steering; Elijah Soule, Duxbury, Plymouth county, Massachusetts, November 3.

The steering is to be effected by means of a cogged wheel which works in a rack, forming the segment of a circle. This circular

segment is affixed to the deck, at its two ends, by metallic pillars, or standards. The hangings of the rudder are the centre of the circle of which the curved rack is a segment. The steering wheel is to be made in the ordinary way, but it has a pinion on its axis which takes into the upper side of the cog wheel, the lower side of which mashes into the rack. The uprights, which support the steering wheel and its appendages, are securely fastened on to the end of the tiller, and traverse with it in steering. There is a contrivance for keeping the rack and cog wheel in gear, and preventing derangement from blows and jerks.

The claim is to 'the application of the steering wheel and pinion on its axis, and the cogged wheel to the curved rack, or segments, to produce a motion of the rudder either to the right or left.'

Instead of the mode of fixing the rack and pinion above described, it is proposed sometimes to attach the rack firmly to the tiller, and the standard of the steering wheel to the deck. This latter mode we should suppose to be the best, as the steersman will then keep his station opposite to the binnacle, whilst in the former mode he has to follow the tiller towards either side of the vessel.

For an improvement in the *Turning Lathe;* John Bisbee, Plainfield, Hampshire county, Massachusetts, November 8.

The lathe here described is intended for turning sticks, used for broom handles, or other purposes, either straight or tapering, and with such ornamental beads, or mouldings, as may be required.

A sliding cat-head, of cast iron, has a hole through it, of such size as just to admit the stick when it has been rounded by a gouge fixed for the purpose. A lever attached to, and working on, a pin in the cat-head, carries a second gouge and a smoothing chisel, the gouge cutting the stick to the size required, and the smoother finishing it as it passes through the hole. There is a contrivance for allowing the cutters to advance for the purpose of making the stick taper, and what is called a buzz, for forming the ornamental parts. The particular construction of the mandril, and of the front centre, are described by the patentee, but those and the other parts relied on as new are not sufficiently well represented in the drawings to give an exact idea of them, so as to enable a workman to make them without exercising his inventive powers. We again repeat the fact that it is of little consequence, in a legal point of view, that they may be understood from an examination of the model; this, we have often said, makes no part of the patent, as it cannot be placed on file, or published for the information of the community.

The claims made are to the 'giving the cat-head such a form that the second cutter, or gouge, and the smoother may be connected with it, and at the same time be raised or lowered by a rest; and placing the edges of the dies in such a position as to cut naturally and smoothly to any size wanted; also the turning buzz,

however it may be applied; the hole and piece in the end of the centre pin; the sliding rest, and the moveable spindle, or mandril, with its ring edge, and edge across its centre.'

Where claims are made, in this way, to the individual contrivances appended to an instrument so long and universally employed as the lathe, there is no small danger of following in the track of a preceding traveller. Cutters in sliding heads, sliding mandrils, buzzes, moveable centres, and most of the things above enumerated, have been repeatedly and variously applied; we think, therefore, that the claim in a case like the foregoing, should be to the general arrangement and combination of the respective parts described, so as to produce the effect intended, and set forth in the description.

For machinery for *Hulling and Polishing Rice*, Barley, &c. &c.; Theodore F. Strong, and Marcus T. Moody, Northampton, Massachusetts, November 17.

The seeds are to be first passed between mill stones, the runner being raised so as merely to crush the hull, then after being winnowed they are to pass through the machine for which the present patent is obtained. This machine consists of a truncated cone on a vertical shaft, working within a hallow truncated cone. The edge of the truncated cone, and the interior of the hollow cone are to be covered with cards, or wire points, in such a way that they shall be elastic. In passing between these, the hulling is to be completely effected. When required to be more perfectly polished, the grain is to be passed again through a similar machine, furnished with a dog-fish skin, bristles, or other suitable substance. The claim is to the machinery made as above described.

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## CAST IRON TRINKETS.

[Translated from the French for the Journal of the Franklin Institute.]

The desire expressed by some of our subscribers to have the receipt for the varnish employed on the cast iron trinkets of Berlin iron, so called, induced us to request a person conversant with the different processes of the arts, to ascertain the best method of making that varnish. We now give a recipe, not for the varnish itself, but for a black coating which can be applied to any description of cast iron articles. This composition is simple, and offers the invaluable advantage of efficaciously resisting the action of the atmosphere, and even of weak acids, so that the process may be employed for coating a great variety of cast utensils commonly used in our families. The coating easily fixes itself on cast iron, and may also be used on hammered iron, but with less certainty of success in the latter case than in the former.

Attach each of the articles to be coated to an iron wire bent above into a hook; and apply a thin coat of linseed oil; the coat must be thin to prevent the oil from running, forming asperities or knots where it collects. Hang them eight or ten inches above a wood fire, so that they may be completely enveloped in the smoke. When they have been thus exposed to a brisk fire for about an hour, lower them so that they shall be near the burning coals, without touching them; at the expiration of about 15 minutes, remove the articles, and immediately immerse them in cold spirits of turpentine.

Any articles which, after this last operation, may be found deficient in brilliancy, or not sufficiently black, are to be re-exposed to the burning coals for a few minutes, and again dipped in the spirits of turpentine.

This process, which may be variously modified to suit different articles, may, from its simplicity, be extensively applied, and will prove useful in all the cases in which cast utensils are subject to rapid oxidation.—[*Journal des Connaissances Usuelles.*

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## A PROCESS FOR VARNISHING LEATHER.

[Translated from the French for the Journal of the Franklin Institute.]

The varnish for leather is the same as that for carriages, except that it contains less copal, and that the oil used in the varnish, for certain coarse articles, should be a little decomposed.

After having dressed and scraped the leather to be varnished, apply upon the flesh side a thin coat of glue water, to which has been added about an ounce of boiled linseed oil. The leather, when dried, is polished, and successive coatings applied until it becomes very smooth. Then mix one part of strong drying oil, (linseed oil, with a considerable dose of litharge,) and one of copal varnish, in an iron vessel, add well pulverized lampblack and spirits of turpentine, and set the whole over a fire. The leather which during this time has been kept in a closet, artificially heated, is now stretched upon a table, a very thin coat of the mixture quickly laid on with a flat brush, immediately replaced in the warm closet, and allowed to dry slowly: when dried it is polished with pumice stone, or which is better, with charcoal finely pounded and sifted. A second coat is applied in the same way, and the operation finishes with a third coat, which should be very lightly laid on, and be very smooth. The leather is now dried without polishing.

Leather for straps, &c. is sometimes manufactured by being passed between rollers; this enables it to receive a higher degree of polish and smoothness. Sometimes the leather is stained with

lampblack mixed in glue water, and finished as we have just described. For articles which are not intended to bend, a greater proportion of copal varnish and more spirits of turpentine are incorporated with the coating mixture. These varnishes are laid on when cold.—[*Ibid.*

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## PRACTICAL SCIENCE.

The practical results of the progress of physics, chemistry, and mechanics are of the most marvellous kind; and to make them all distinct would require a comparison of ancient and modern dates. Ships that were moved by human labor in the ancient world, are transported by the winds; and a piece of steel, touched by the magnet, points out to the mariner his unerring course from the old to the new world; and by the exertions of one man of genius, and by the rosources of chemistry, a power which, by the old philosophers, could hardly have been imagined, has been generated and applied to almost all the machinery of active life; the steam engine not only performs the labor of horses, but of man, by combinations which appear almost possessed of intelligence; wagons are moved by it; constructions made; vessels caused to perform voyages in opposition to the wind and tide, and a power placed in human hands which seems almost unlimited. To these novel and still extending improvements may be added others, which, though of secondary kind, yet materially affect the comforts of life—the collections from fossil materials, the elements of combustions, and applying them so as to illuminate by a single operation, houses, streets, and even cities. If you look to the results of chemical arts, you will find new substances of the most extraordinary nature applied to various and novel purposes. You will find a few experiments in electricity leading to the marvellous results of disarming the thunder cloud of its terrors, and you will see new instruments created by human ingenuity, possessing the same powers as the electrical organs of living animals. To whatever parts of the vision of modern times you cast your eyes, you will find marks of superiority and improvement; and I wish to impress upon you the conviction, that the results of intellectual labor, or scientific genius, are permanent and incapable of being lost. Monarchs change their plans, governments their objects, a fleet or an army effects its purposes and then passes away; but a piece of steel touched by the magnet, preserves its character forever, and secures to man the dominion of the trackless ocean. A new period of society may send armies from the shores of the Baltic to those of the Euxine; and the empire of the Mahometan may be broken in pieces by a northern people, and the dominions of the

Britons in Asia may share the same fate as that of Tamerlane or Genghis Khan; but the steam boat that ascends the Mississippi or the St. Lawrence, will continue to be used, and will carry the civilization of an improved people into the deserts of North America and into the wilds of Canada.—*Sir Humphrey Davy.*

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For the Young Mechanic.

## REMARKS ON HAINSSELIN'S POWER MACHINE.

In the May number of the New York Mechanic's Magazine, is an account of a 'Machine or Motive Power for giving motion to Machinery of different descriptions;' which is copied from the Repertory of Arts for March. The description is accompanied with neat engravings of both the front and side views of the machine; which is very complex, and yet, very ingenious. Air and water are the two principal agents in this machine. The water is raised by two pumps, to a cistern placed high enough to supply an endless chain of buckets, which answer the purpose of a water wheel; and when in motion it turns a drum, and a large cog wheel on the same shaft, which gears into a pinion on another shaft; on which is a fly wheel, and an eccentric which moves a huge pendulum. The pendulum gives motion to the two water pumps, and is assisted by condensed air from an air chamber, that acts alternately on pistons fixed on the pump rods, and works in the upper part of the pump barrels. There is also an air pump with a lever to be worked by hand.

And now, kind reader, what do you suppose is the moving power of this wonderful machine, that is to give motion to other machinery in the same manner that a steam engine does? Why, all that I can find is the power of a man, or a boy, as the case may be, for he it is that compresses the air; the air works the pumps; the pumps raise the water; the water turns the wheels; the wheels move the pendulum; the pendulum works the pumps, but not without the compressed air; and now we are got back to the boy again; and I will leave others to calculate how much he can do.

PHILO.

# Miscellany.

*Pin Machine.*—Mechanical ingenuity is certainly an attribute of the American man. We have just seen a beautiful exemplification of it in a pin-making machine, invented by Dr. John I. Howe, of this city, who sails with it in a day or two for England, there to procure a patent for it.

The model machine is small, beautifully made, and worked by hand. We saw it in operation, and from two sorts of wire with which it was fed—one stout for the pin, the other fine, which is twisted into the head—we saw pins complete poured forth at the rate of 40, and with the capability of producing 60 in a minute. The pins are perfect in every thing but the coloring, which, as in all cases of pin-making, is imparted by a chemical wash afterwards.

The machines now used for pin making, only make the pin, the head being afterwards put on by hand, to each separately. Here the head is more firmly, uniformly, and smoothly made and fastened on by the machine.

We cannot doubt that this all but *reasoning* machine will well reward its ingenious inventor.—*N. Y. American.*

*Water in the Desert.*—Two persons who understood the business of boring for water, were lately taken to Egypt, by Mr. Briggs then Consul at Cairo. They were employed under patronage of the Pacha to bore for water in the Desert. 'At about thirty feet from the ground,' says the Repertory, 'by Patent inventions they found a stratum of sand stone; when they got through that an abundant supply of water was procured. We believe the experiment has succeeded at every place where it has been made. The water is soft and pure.' In the Desert of Suex a tank has been made of 2000 cubic feet contents, and several others are in building.

*Results of Accident.*—Many of the most important discoveries in the field of science have been the result of accident. Two little boys of a spectacle maker in Holland, while their father was at dinner, chanced to look at a distant steeple, through two eye-glasses placed before one another. They found the steeple brought much nearer than usual to the shop-windows. They told their father on his return; and the circumstance led him to a course of experiments, which ended in the *telescope.* Some ship-wrecked sailors once collected a few sea-weeds on the sand, and made a fire to warm their shivering fingers, and cook their scanty meal. When the fire went out, they found that the alkali of the sea-weed had combined with the sand, and formed *glass;*—the

basis of all our discoveries in astronomy, and absolutely necessary to our enjoyment. In the days when every astronomer was an astrologer, and every chemist a seeker after the philosopher's stone, some monks carelessly mixing up their materials, by accident invented *gunpowder*, which has done so much to diminish the barbarities of war. Sir Isaac Newton's two most important discoveries—*light* and *gravitation*—were the result of accident. His theory and experiments on light were suggested by the soap-bubbles of a child; and on gravitation, by the fall of an apple, as he sat in the orchard. And it was by hastily scratching on stone a memorandum of some articles brought him from the washer-woman's, that the idea of lithography first presented itself to the mind of Senefelder.—*Am. Bap. Mag.*

*Beautiful Experiments on the Hydro-oxygen Microscope.*—We were yesterday admitted at Stanley's, No. 21, Old Bond street, to a private view of one of the most extraordinary exhibitions we ever remember; it is denominated the hydro-oxygen microscope, and is an application of the light employed by Lieut. Drummond on the trigonometrical survey to microscopic purposes. A stream of oxygen gas, and another of hydrogen gas, (the chief constituents of water) are brought into union, and projected in an ignited state upon a mass of lime, producing a light of intense brilliancy, which, passing through a lens, throws the images of objects magnified from 10,000 to 500,000 times, in the manner of a solar microscope, upon a disk of 14 feet diameter. The inanimate objects consisted of fragments of insects' wings, of *fuci*, sea-weed, woods, hair, &c; all the minute external properties of which were shown upon an exaggerated scale. A few hairs of an infant appeared like tubes of two inches in diameter. A small portion of the human *pericardium* exhibited the courses of the arteries and veins. The penetrating nature of the light revealed the interior confirmation of the fleas and spiders in the object glasses. The sting of a bee was a monstrous barbed weapon, four feet long. The lancets of the horse-fly were sabres about two feet in length. The next curious part of the exhibition consisted of the small animalculæ in a drop of water, some of which are seen preying upon each other. Some skeleton larvæ were from their diaphanous texture, beautifully developed, exhibiting even the vesicle of air which enables them to rise or descend in the water; and some of the worms found in stagnant ditches, the natural size of which is a thread, appeared like the largest sized boa-constrictor. It is in short, an exhibition worthy to engage the attention of natural philosophers of the highest class, as well as of the merely curious. The instrument is constructed under the superintendence of Mr. Cooper, professor of chemistry, and Mr. Cary, the optician. The former gentleman attends and explains, very clearly and scientifically the different objects. The exhibition was crowded with

company, including persons of rank and science, Lord Sidmouth Lord Dover, Mr. Farraday, Mr. Babbage, Professor Buckland, &c.—*London Times.*

*Early Application of Gunpowder to the Civil Arts.*—In the life of Sir Christopher Wren, the scientific Architect who rebuilt London after the great fire in Charles II.'s time, we find that that great man used *gun powder* to bring down the old walls of St. Paul's, before the erection of that noble and beautiful piece of architecture, the present St. Paul's Cathedral, inferior in size and beauty to no building in the world, unless it be St. Peter's at Rome, which occupied twenty architects, and was in the course of building during nineteen *successive Popes.* The method he used was very similar to that which we now use for blasting rocks, or raising the stumps of trees; but the admirable precision with which he estimated the exact quantity, in his *first* attempt, is well worth notice, as it marks the sound reasoner and practical philosopher. The following is the description of the method he adopted to pull down the walls before referred to.

'To perform this work, he caused a hole to be dug, of about four feet wide, by the side of the north-west pier of the tower, in which was perforated a hole two feet square, reaching to the centre of the pier. In this he placed a small deal box, containing eighteen pounds of gunpowder. To this box he affixed a hollow cane containing a quick match, reaching to the surface of the ground above, and along the ground a train of powder was laid with a match. The mine was then closed up, and exploded, while the philosophical architect waited with confidence the result of his experiment.

'This small quantity of powder, not only lifted up the whole angle of the tower, with two great arches that rested upon it, but also two adjoining arches of the aisles, and the masonry above them. This it appeared to do in a slow but efficient manner, cracking the wall to the top, lifting visibly the whole weight about nine inches, which suddenly dropping made a great heap of ruins in the place without scattering or accident. It was half a minute before the heap already fallen opened in two or three places, and emitted smoke. By this successful experiment the force of gunpowder may be ascertained: eighteen pounds only of which, lifted up a weight of more than three thousand tons, and saved the work of a thousand laborers.'

The erection of the St. Pauls, now standing, occupied *thirty-five years*, under *one* architect and *one* bishop, which is rather singular, for men do not arrive at the head of their professions, generally, at a very early age, and the *first architect* and the first bishop, are seldom *very young men.* It was finished in 1710.—*Mechanics' Assistant.*

THE

# YOUNG MECHANIC.

AUGUST, 1833.

## CHEMISTRY.

### WATER.

WATER is, by far, more abundant than any other liquid on our globe. It is essential to animal and vegetable life;—and an important agent in promoting the numerous chemical changes which are continually taking place among the works of nature. It was believed by the ancients to be one of the four elements out of which they imagined all other substances were formed; and this opinion maintained its ground for a long time. The composition of water was not ascertained until the year 1781, when it was proved, by McCavendish, to be composed of oxygen and hydrogen, by uniting these substances. This experiment was soon afterwards repeated by numerous other individuals, among them that of Fourcroy, Vauguelin and Seguin, is worthy of particular notice; in this experiment oxygen and hydrogen gases were kept burning for more than a week. The oxygen was prepared from chlorate of potassa and the hydrogen from water decomposed by zinc and sulphuric acid;—both of the gases were passed through caustic alkali before using.

The weight of the hydrogen employed was 1039·358 grains, that of the oxygen 6209·869 gr.; making in all 7249·227 gr. The weight of water obtained was 7244 gr. Upon examination of the water it was found to be as pure as distilled water.

Pure water is transparent, tasteless, colorless, and without odor. According to the parliamentary standard of Great Britain a pint of water weighs 8750 gr. and a cubic inch 252.458 gr. at 62° F. Bar. 30 inches.

Its specific gravity is supposed to be 1000, and it is made the measure of the specific gravity of all other bodies.

'The refractive power of water is very high, owing, as is supposed, to the hydrogen which it contains. By a vigorous stroke in a syringe, water emits a flash of light.—Thenard.

It is a slow conductor of heat. The rapidity with which water may be heated, when heat is applied to the bottom of a vessel containing it, is owing to the interchange, which takes place, among its particles. If heat be applied to the surface of water in a vessel which conducts heat slowly, a long time will be required before the temperature of the water, in the lower part of the vessel, will be altered.

Its combining weight is represented by 9.

According to the results of Dr. Thomson, oxygen gas is 16 times heavier than hydrogen gas, and as water consists of two volumes of hydrogen and one of oxygen, 1 part by weight of hydrogen and 8 parts of oxygen constitute water. Assuming that water is a compound of one atom of hydrogen united with one atom of oxygen, the representative number of hydrogen will be 1, and that of oxygen 8 and $1+8=9$ the representative number for water.

It absorbs a portion of every gas. Henry asserts that under additional pressure equal to the atmosphere, twice as much will be absorbed, and under a pressure equal to three atmospheres, three times as much will be absorbed, and so on.

From the atmosphere it absorbs oxygen rather than nitrogen. A quantity of air separated from rain water by boiling, contained about 10 per cent. more oxygen than is contained in the atmosphere. It is to the air which water contains that it owes its agreeable flavor; freed from air it is rendered insipid.

By combination with some bodies water becomes solid. A familiar instance of this is its combination with lime; it is seen also, in numerous crystals. At a temperature of 32° Fah. it becomes ice, and its specific gravity is diminished to about 0·940; the density is dependent, however, upon the temperature at which it formed, and the time required for congelation. It crystallizes in acicular needles, crossing each other at angles of 60 and 120°.

Water, when at the temperature of 42° F. expands in bulk as much for each degree abstracted from, as added to its temperature, provided it be not frozen so that at temperatures of 32° and 52° Fah. its bulk will be the same. By careful cooling, water may be reduced to 22° and remain liquid; but if agitated, instantly congeals. The expansive force of water, during its conversion into ice, has not been accurately ascertained; in the experiment made by Major Williams, at Quebec, bomb shells, thirteen inches in diameter, and more than two inches thick, were burst by filling them with water and exposing them to a low temperature. In some, the plugs which closed the fuse holes, were thrown to a great distance; one is mentioned, as having been thrown a distance of 415 feet.

Ice, at a low temperature, is hard, tough and elastic; at the celebrated palace of ice constructed by order of the Empress Catharine, cannon formed of it sustained several discharges without bursting.

In warm climates recourse is had to evaporation and radiation for producing ice; for this purpose water is placed in small unglazed earthen vessels, laid upon straw and reeds in shallow pits during calm evenings, when the sky is clear. It may be formed also by placing water in a vessel over sulphuric acid, and removing the atmospheric pressure by the air pump, or more easily by surrounding a vessel of water with a compound of 2 parts sulphuric acid and 2 parts water which has been suffered to cool after mixing, and adding to it 5 parts of sulphate of soda.

According to Dr. Black, 1 pound of ice during its liquefaction absorbs as much caloric as would raise the same quantity of water 140°.

Water boils at a temperature of 212° F., when the barometer is at 30, and is converted into steam, thereby increasing to about 1800 times its former bulk. The boiling point varies with the atmospheric pressure as is shown in the following table:

| Barometer. | Boiling point. | Barometer. | Boiling point. |
|---|---|---|---|
| 31. | 213.76 | 29 | 210.19 |
| 30.5 | 212.88 | 28.5 | 209 31 |
| 30 | 212 | 28 | 208 43 |
| 29.5 | 211.07 | 27.5 | 207.55 |

The elastic force of the vapor of water, measured by the height of the column of quicksilver that it will support, is shown in the following table by Dr. Ure. The temperature is expressed in degrees of Farenheit's scale, and the force in inches of mercury.

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 24° | 0.170 | 115° | 2.820 | 195° | 21.100 | 212° | 53.600 | 270° | 86.300 | 295.6° | 130.400 |
| 32 | 0.200 | 120 | 3.300 | 200 | 23.600 | 245 | 56.340 | 271.2 | 88.000 | 295 | 129.000 |
| 40 | 0.250 | 125 | 3.830 | 205 | 25.900 | 215 8 | 57.100 | 273.7 | 91.200 | 297.1 | 133.900 |
| 50 | 0.360 | 130 | 4.366 | 210 | 28.880 | 248.5 | 60.400 | 275 | 93.480 | 298.8 | 137.400 |
| 55 | 0.416 | 135 | 5.070 | 212 | 30.000 | 250 | 61.900 | 275.7 | 94 600 | 300 | 139.700 |
| 60 | 0.516 | 140 | 5.770 | 216.6 | 33.400 | 251.6 | 63.500 | 277.9 | 97.800 | 300.6 | 140.900 |
| 65 | 0.630 | 145 | 6.600 | 220 | 35.540 | 254.5 | 66.700 | 279.5 | 101.600 | 302 | 144.300 |
| 70 | 0.726 | 150 | 7.530 | 221.6 | 36.700 | 255 | 67.250 | 280 | 101.900 | 303.8 | 147.700 |
| 75 | 0.860 | 155 | 8.500 | 225 | 39 110 | 257.5 | 69 800 | 281.8 | 101.400 | 305 | 150.560 |
| 80 | 1.010 | 160 | 9.600 | 226.3 | 40.100 | 260 | 72.300 | 283.8 | 107.700 | 306.8 | 154.400 |
| 85 | 1.170 | 165 | 10.800 | 230 | 43.100 | 260.4 | 72.800 | 285.2 | 112.200 | 308 | 157.700 |
| 90 | 1.360 | 170 | 12.050 | 230.5 | 43.500 | 262.8 | 75.900 | 287.2 | 114.800 | 310 | 161.300 |
| 95 | 1.640 | 175 | 13.550 | 234.5 | 46.800 | 264.9 | 77.900 | 289 | 118.200 | 311.4 | 164.800 |
| 100 | 1.860 | 180 | 15.160 | 235 | 47.220 | 265 | 78.040 | 290 | 120.150 | 312 | 167.000 |
| 105 | 2.100 | 185 | 16.900 | 238.5 | 50.300 | 267 | 81.900 | 292.3 | 123.100 | | |
| 110 | 2.456 | 190 | 19.000 | 240 | 51.700 | 269 | 84.900 | 294 | 126.700 | | |

If water be brought in contact with some of the metals heated to redness, the oxygen of the water combines with the metal, and the hydrogen will be set free.* The common process is to fill a green glass, or earthen tube, with clean iron filings, and place the tube

*Iron, zinc, antimony, tin, manganese, potassium, sodium and probably the metalic bases of all the alkaline earths, decompose water.

in a furnace so that both ends may project, having adapted to one end a retort containing water, and to the other a bent tube, leading under a bell glass filled with, and inverted over water, a fire is made in the furnace and the tube heated to redness; the water in the retort is then heated, the steam coming in contact with the heated iron, is deprived of oxygen, and the hydrogen is collected in the bell glass.

Water may be also decomposed by substituting charcoal for iron in the same aparatus, but the hydrogen obtained, will be contaminated by carbonic acid, carbonic oxide, and carburetted hydrogen gases.

For the best process of decomposing water, we are indebted to Messrs. Nicholson and Carlisle, who first discovered the chemical action of the galvanic battery by decomposing water.

If wires of gold or platinum, connected with the poles of a galvanic battery, have their ends placed in a vessel of water, decomposition of the water will immediately commence, and bubbles of gas will be seen forming around the wires. By using two tubes (closed at one end with a cork through which the wire is passed) filled with water, the gases may be collected; the oxygen in the tube connected with the positive, and the hydrogen in the tube connected with the negative pole of the battery.

The most suitable water for chemical operations is rain water. When required for experiments, where acuracy is desired, it should be slowly distilled from glass or silver vessels, preserving the portion which comes over, after about 1-6th has been distilled, and stopping the operation when about three-fourths has passed over.

Water proper to be drank may be distinguished by the following characters: It is perfectly clear, has a lively taste, possesses no odor, and unites with soap without forming lumps. If a solution of nitrate of silver be added, no precipitate will be formed.

To remove the bad qualities of water, several methods are employed. Stagnant waters are set in motion by means of mills, or made to pass through the air by means of jets, cascades, &c. From standing waters the vegetable and animal matters susceptible of putrefaction are removed. The beds of streams which are muddy, are covered with clean sand, or the water is filtered. To separate substances which it holds in solution, boiling is resorted to, sometimes with the addition of a little potash or wood-ashes, and afterwards exposed to the air in shallow vessels. For filtering water, the common filtering stone answers very well, but soon becomes clogged; a vessel with a bottom formed of sponge, closely compressed, answers better and is more easily cleaned. The French make use of cisterns divided into two parts by a partition reaching nearly to the bottom. The part of the cistern into which the water is first conveyed is about half filled with sand, of different degrees of fineness, the finest being at the bottom, through this the water passes clear into the other part of the cistern

[To be Continued.]

## GEOMETRY AND ARITHMETIC.

[Continued from page 104.]

### CIRCLE.

I ENDEAVORED in my last, to explain the method of finding the ratio of the diameter of a circle to the circumference. It has been found that if the diameter be 1, the circumference will be 3·1416; and if one be doubled, the other will be doubled also; or, if one be increased tenfold, the other will be increased tenfold, &c. both increasing or diminishing in the same ratio; so that to find the circumference of a circle when the diameter is given, it is only necessary to increase (3·1416) the circumference of unity, as many times as the diameter contains unity; or, multiply 3·1416 by the diameter and the product will be the circumference. Thus, if the diameter be 8, the circumference will be 25·1328. It is shown geometrically at page 89, that the area of a circle is found by multiplying half the diameter by half the circumference. Having found the ratio between the diameter and circumference, we may now find the area itself. Suppose it be required to find the area of a circle whose diameter is 1, and circumference 3·1416. We must multiply the half of 1, which is ·5, by the half of 3·1416, which is 1·5708.

| | | |
|---|---|---|
| Thus | 1·5708 | half the circumference. |
| Multiplied by | ·5 | half the diameter. |
| Gives | ·78540 | the area. |

With the area (0·7854) of a circle whose diameter is 1, we may find the area of any other circle from the diameter, without knowing what the circumference is; for the areas of circles increase or diminish, as the squares of their diameters increase or diminish, (see page 43.) Hence if 0·7854 be multiplied by the square of the diameter, the product will be the area. Suppose the diameter to be 2, the square of 2 is 4; and 4 times 0·7854 is 3·1416 the area of a circle whose diameter is 2. To make this more clear, let us analyze the process. Take a circle whose diameter is one inch, its area will be one circular inch, or 0·7854 parts of a square inch; that is, if a square inch be divided into ten thousand parts, a circular inch will contain or be equivalent to 7854 of those parts. By squaring the diameter, we get the number of circular inches contained in the circle; and by multiplying these circular inches by 0·7854 we reduce them to square inches.

It will be well for those who wish to pursue this subject, to commit the two numbers 3·1416 and 0·7854 to memory, they are called factors, and are expressed decimally; but I am afraid many

of our young mechanics are not sufficiently acquainted with decimals, to enable them to take that interest in this very useful subject that they otherwise would; for whose benefit before I proceed further, I will give a brief explanation of decimal fractions; and then point out other useful factors, with their applications.

PHILO.

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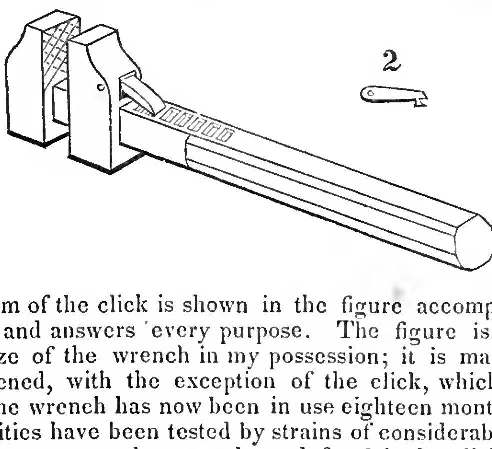
*Philadelphia, May 18th,* 1833.

## DESCRIPTION OF A NEW RACK WRENCH*.

TO THE COMMITTEE ON PUBLICATIONS.

GENTLEMEN,—In reading over the list of patents in the April number of the Journal of the Institute, I was struck with the great similarity of a rack wrench, patented by Mr. King, (see page 240,) with one invented by me, and made eighteen months ago. In the first plan which occurred to me, I intended to employ a spring to keep the click of the wrench in its place, but I preferred not to use it on account of its liability to get out of order.

Fig. 1.



2

The form of the click is shown in the figure accompanying; it is simple, and answers every purpose. The figure is drawn to the full size of the wrench in my possession; it is made of iron case hardened, with the exception of the click, which is of cast steel. The wrench has now been in use eighteen months, and its good qualities have been tested by strains of considerable amount.

Fig. 1 represents the wrench, and fig. 2 is the click which is shown in its place in fig. 1. They are one-fifth the full size. —[*Journal of the Franklin Institute.*

* Invented by Mr. Alfred C. Jones steam engineer. For an account of Mr. King's patent, see Young Mechanic page 99.

## EXCELLENCE NOT LIMITED BY STATION.

There is not a more common error of self-deception than a habit of considering our stations in life so ill-suited to our powers as to be unworthy of calling out a full and proper exercise of our virtues and talents.

As society is constituted, there cannot be *many* employments which demand very brilliant talents, or great delicacy of taste, for their proper discharge. The great bulk of society is composed of plain, plodding men, who move 'right onwards' to the sober duties of their calling. At the same time the universal good demands that those whom Nature has greatly endowed should be called from the more ordinary track to take up higher and more ennobling duties. England, happily for us, is full of bright examples of the greatest men raised from the meanest situations; and the education which England is now beginning to bestow upon her children will multiply these examples. But a partial and incomplete diffusion of knowledge will also multiply the victims of that evil principle which postpones the discharge of present and immediate duties, for the anticipations of some destiny above the labors of a handicraftsman, or the calculations of a shop-keeper. Years and experience, which afford us the opportunity of comparing our own powers with those of others, will, it is true, correct the inconsistent expectations which arise from a want of capacity to set the right value on ourselves. But the wisdom thus gained may come too late. The object of desire may be found decidedly unattainable, and existence is then wasted in a sluggish contempt of present duties; the spirit is broken; the temper is soured; habits of misanthropy and personal neglect creep on; and life eventually becomes a tedious and miserable pilgrimage of never-satisfied desires. Youth, however, is happily not without its guide, if it will take a warning from example. Of the highly gifted men whose abandonment of their humble calling has been the apparent beginning of a distinguished career, we do not recollect an instance of one who did not pursue that humble calling with credit and success until the occasion presented itself for exhibiting those superior powers which Nature occasionally bestows. Benjamin Franklin was as valuable to his master, as a printer's apprentice, as he was to his country as a statesman and a negotiator, or to the world as a philosopher. Had he not been so, indeed, it may be doubted whether he ever would have taken his rank among the first statesmen and philosophers of his time. One of the great secrets of advancing in life is to be ready to take advantage of those opportunities which, if a man really possesses superior abilities, are sure to present themselves some time or other. As the poet expresses it, 'There is a *tide* in the affairs of men,'—an ebbing and flowing of the unstable element on which they are born,

—and if this be only 'taken at the flood,' the 'full sea' is gained on which 'the voyage of their life' may be made with ease and the prospect of a happy issue.

But we should remember, that, for those who are not *ready* to embark at the moment when their tide is at its flood, that tide may never serve again; and nothing is more likely to be a hindrance at such a moment than the distress which is certain to follow a neglect of our ordinary business.—[*Mechanics' Magazine.*

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For the Young Mechanic.

## AMPHIBIOUS STEAMER.

The amazing success with which steam has of late been applied, both on land and water, surpasses the most sanguine expectations of the mechanical student; and almost realizes the imaginations of the poet, who says,

> 'Soon shall thy arm, unconquer'd steam! afar
> Drag the slow barge, or drive the rapid car;
> Or, on wide waving wings expanded bear
> The flying chariot through the fields of air.'

But before we are prepared to mount into the air, by the force of steam, it will be necessary to make another improvement, so as to unite the steam boat and steam carriage in one machine, that will be capable of travelling on both land and water. I believe this can be done on a small scale, for pleasure if not for profit. A boat can be made light enough to answer for the body of a carriage, and yet strong enough to bear a little beating about at sea. At least, it would do to cross a pond or small lake, and perhaps a river whose current is not very rapid. It will be necessary to have wheels to run on the ground, which may serve also for paddle wheels, or what would be still better, it might have separate paddle wheels similar to those in common use. The ends of the boat must be turned up, so as to enable it to pass in and out of the water without wetting the deck.

Having faintly described this new steamer, let us now imagine a little excursion with it. Suppose all the passengers safely on board, and she starts from some central part of the city; and enter the bay by a gently inclined road. Very soon after the fore part of the boat touches the water, the fore wheels will leave the inclined plane; and when she is afloat, the paddle wheels may be set in motion. (In crossing some rivers, velocity enough may be given in descending, to drive her across to the inclined plane on the opposite side without the use of paddle wheels.) We may now visit the islands in the bay, catch a few fish, and afterwards proceed to Nahant, or pass up the beach at some suitable place, and return by land, crossing the ferry from Chelsea, to the place from whence we started. PHILO.

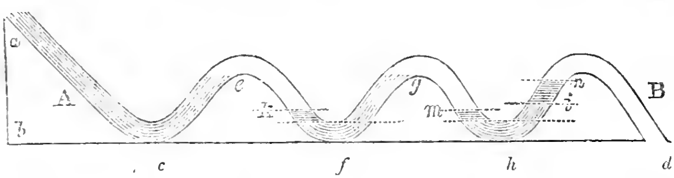
## WATER IN PIPES OBSTRUCTED BY AIR.

An account of the Passage of Water through an Aqueduct being totally obstructed by collections of Air; and on the Equilibrium of different fluids in bent tubes. By D. Treadwell.

A lead pipe, having a bore an inch and a half in diameter, was laid from a well in Roxbury to the mills at the water works on the Boston mill-dam for the purpose of supplying the workmen, who carry on the various manufactories erected on the mill-dam, and their families, with fresh water. The surface of the water in the well was found by a survey to be somewhat higher than any of the ground through which the aqueduct passed. The whole length of the aqueduct was about 6000 feet, and its general course was through a salt marsh ; in its way, however, it passed under the bed of two creeks, which may be taken at 12 feet deep, each, and near its termination it descended from the marsh to the bed of the bay, on which the mill-dam is built. It was laid about three feet beneath the surface of the marsh, and opened into a reservoir at the city mills four feet below the level of the surface of the water in the fountain well.

After completing the aqueduct and opening it into the well, it was found that not a drop of water would run through it. As it was known that there were no mechanical obstructions in the pipe, it was thought not a little anomalous that the water should not pass through it.

In this state of things I was requested by those interested in the aqueduct, to consider the circumstances, and endeavor to procure a passage of the water. When the exact condition of the aqueduct was taken into consideration, I perceived that the water let into it might have made such an arrangement, in relation to the air with which the pipe was previously full, as to obstruct wholly its passage. For let us suppose in the annexed figure, A B to represent a pipe open throughout its length, but its




sides being perfectly tight, and having the several vertical flexures here represented, and let it be required to pass water, or any heavy fluid, through it in the direction from A to B, the end A being elevated the distance $a\ b$ above B, $c\ d$ being a horizontal line. It is evident that the water being let into the end at $a$ will pass and fill the pipe to $e$, displacing all the air with which the pipe, being open to the atmosphere, was previously full. Flowing

over the curvature *e* in a stream or column less than the bore of the pipe, it fills the curvature at *f* without displacing the air previously contained in the descending section from *e* to *f*. This air is thus shut up, and cannot pass from the pipe in any direction without passing under the water, which, from its inferior specific gravity is impossible. The water, continuing to flow over the flexure *e*, rises from *f* to *g*, and flowing over this flexure the same thing is repeated, as to the air from *g* to *h*, which took place at the flexures *e* and *f*. Rising from *h* until it attains some point, *i* for example, at which the sum of the perpendicular heights of the ascending columns *c e*, *f g*, &c. is equal to the height of the column *a b*. That is, if we suppose the air to be un-elastic and void of weight, but as this is not true in fact, the air will be condensed in a greater or less degree according to its volume and the height of the columns of water opposed to it. In consequence of this condensation, the water will rise, as shown in the figure, to *k* and *m* for example, and the weight of these columns being added to the effective force of the column *a b*, produces a rise of the water to some point, *n*, in the flexure *h n*. There is then a perfect equilibrium in the opposing forces, and the water can flow no farther. This equilibrium may be expressed generally by

$$a\,b + c\,d = b\,e$$

in which *a* is the perpendicular height of the water in all the descending flexures; *b* its density; *c* the perpendicular height of all the inclosed air; *d* its mean density; and *e* the perpendicular height of all the ascending columns of water.

Several writers on Hydrodynamics have noticed the obstruction which air often presents to the passage of water in bent tubes; but in the works that I have had an opportunity of consulting, the authors appear to regard the air as collecting in the high parts of the tube, and partially closing its bore, thus diminishing without totally obstructing the discharge. This is quite different from the effect of the arrangement which I have attempted to explain.—Those, however, who are acquainted with this subject will recollect the Zurich machine for raising water, invented many years since, as owing its efficacy to an arrangement which the air and water take in a spiral tube, very similar to that stated in the preceding part of this paper.

As the aqueduct at the mill-dam was more or less bent through its whole course, the flexures being considerable at the creeks under which it passed, it appeared to me certain that it was partly filled with air, and that this alone interrupted the flow of water. On opening small holes into it in several places, air rushed out in great quantity; still, however, the water did not flow at the reservoir, and as it was impossible to get at the bendings in every part of the pipe without the labor of uncovering it wholly, the design of freeing it from air by piercing it with small holes was suspended. A forcing pump was then coupled to the upper end of the pipe, and water, which had been heated in the worm tube of a distil house, in the vicinity, was forced into it. The pump was furnished

with a valve loaded with a weight equal to a column of water 80 feet high, and a very small opening made from the aqueduct into the reservoir at the mills, so that the water passing slowly through the whole length of the aqueduct was there discharged. The object of this apparatus was to produce an absorption of the air by bringing it in contact, under heavy pressure, with water which had parted with some of its air by being heated; as these conditions are known to be favorable to the absorption of air by water. The pumping was continued about ten days, and the quantity of water used may be taken at 20 hogsheads; when the pump was taken off, and the aqueduct opened into the fountain. The water was then found to flow at the reservoir, discharging as much as was due to the head. This discharge has continued uninterruptedly to the present time, about five months. There can be no doubt but much air was absorbed, its presence in the aqueduct being indicated, when the pumping was commenced, by its throwing a stream of water out of the pipe, on which the loaded valve was placed, whenever the weight was removed from the valve. The quantity of water thus thrown back was much too great to have been produced from the elasticity of the water or the lead pipe, and it diminished daily, having almost ceased before the pump was taken off.—[*Boston Journal.*

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## PATENTS FOR MASSACHUSETTS.

*Granted in December, 1832.*

From the Journal of the Franklin Institute.

For an improvement in the *Machine for preparing Cotton Roving;* John A. Bradshaw, Foxborough, Norfolk county, Massachusetts, December 8.

Without the drawings we cannot give a clear idea of the proposed novelty, which consists in the application of a spring to the flyer, in such a way, and so constructed, as to give a slight degree of twist and condensation to the roving; a purpose which persons acquainted with the subject are aware has been accomplished in various ways.

For the *Application of Cork to the filling of Beds*, and other useful purposes; Stephen Bates, Boston, Massachusetts, December 25.

The cork is to be first dried, and then ground, or grated, to reduce it into pieces the size of a walnut, and smaller. When so prepared it is to be used for all the purposes of stuffing to which feathers, wool, hair, &c. are applied. Beds, mattresses, and pillows, so stuffed will, we are told, serve the purpose of life preservers, in case of disaster in steam-boats, and other vessels.

For a *Vertical tortive wire door spring;* John Codman, Boston, Massachusetts, December 28.

The point, or part, claimed in the specification of this patent, is not that which the title would indicate; and that part of the apparatus which is claimed as new, is described in such a way as would seem to confine the inventor to the exact form and arrangement given by him. The door spring is to consist of a piece of wire about twice as long as the height of the door. This wire is to be doubled, leaving a loop at one end, which may be hooked upon a metallic plate screwed on to the door, near its bottom, and to the hinged joint. The wires are to be lightly twisted together, making one turn round each other in about a foot. An apparatus, called the graduator, is to be fastened on to the door casing, just above the hinge joint of the door. Into a wheel having teeth upon a projecting rim, formed in the manner of a crown wheel, the two ends of the wire are to be secured, about five-eighths of an inch apart. When the wheel is turned upon its centre pin as it stands horizontally, the twist of the wires will be thereby regulated. The teeth surrounding the wheel are to receive a pin to retain it in any required position. The claim is to 'the regulating box, and the teeth and groove of the regulator, and the application of them.'

The thing to be effected is so simple, and the modes in which it may be done so numerous, and some of them so much less complex than the one proposed, that a claim so restricted appears to be of little value.

For a *Machine for pressing Straw and other Hats;* Otis Plimpton, Foxborough, Massachusetts, December 28.

The apparatus here described consists, in part, of a suitable block, fixed to the frame work of the machine, and upon which the hat is to be placed when pressed, which is done by a heated flat iron; to this a horizontal motion is given by a shaft carrying an eccentric, which acts upon a lever, to the opposite end of which the pressing iron is attached. By placing the foot upon a treadle, the pressure may be regulated in any required degree. There are a number of different contrivances for throwing the machine in and out of gear, and for other purposes, which cannot be shown without the drawing.

For an improvement in the *Machine for Ruling Paper;* Alfred Hathaway, Troy, Bristol county, Massachusetts, December 31.

It is intended, when necessary, to rule the paper on both sides by placing it once on this machine; we cannot without the drawings give a good idea of its construction, and even with them it is not easy to trace the particular operation and arrangement of some of its essential parts; the description not being sufficiently in detail.

The claims made are to 'the ruling both sides of paper at one operation. The application of the motion to the machine, and the general arrangement of the machine, and the operating of it by one person. The peculiar construction of the pens. The application of the pens to the top of the cylinder.'

## STONE-SPLITTING SCREWS.

The following extract is from the London Mechanics' Magazine; by which it appears, that Mr. Robert Mallet has succeeded in using the screw instead of gunpowder, for splitting rocks. He has tried it with success on slate, and the softer kinds of stone; but whether it will answer for the harder kinds, remains to be proved. If this invention should be extensively adopted, it may be the saving of many lives and limbs.

Sir,—Some time since, while visiting the Bangor slate quarries, I was struck with the enormous waste of materials, arising from the mode adopted of shaking down large masses of slate to be afterwards split into roofing slates. The strata lie nearly vertical, and by every blast that is fired many tons of slate are shivered to atoms and made useless.

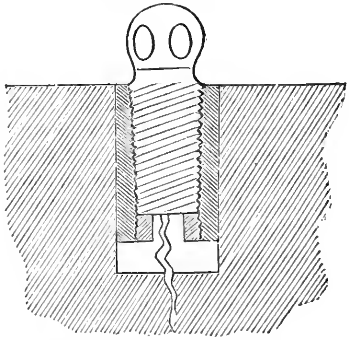
As a remedy for this, some powerful but simple application of the wedge appeared to me to be worthy of consideration. A conical male screw, working in a split female screw, placed in a jumper hole in the stone to be cleft, appeared one of the best that occurred; and, upon subsequent experiment, I find it to exceed my expectations, both for splitting, roofing, slate-work, and all other stones.

The screw which I had made as an experimental one, is about nine inches long in the screw, and two inches diameter at the lower end, and two inches and an eighth at the upper. It has a round thread, of as strong a form as possible, and a proper eye at the top for the insertion of a lever. The two segments of a cylindrical shell, which form its nut or box, are each one-fourth the circumference of a complete cylinder, and half an inch in thickness; thus the jumper hole for this screw requires to be three inches diameter and nine inches deep.

The screw is made of iron, sheathed with steel like a tap, and hardened; and the box segments are made of cast iron, poured in an iron mould, which makes the screw threads very perfectly and cheaply; their brittleness and hardness are afterwards corrected by annealing. They alone are injured in the operation of splitting, and by this way of making them, are easily replaced.

Now, I am fully aware of the objections that may be urged, of a conical screw being applied to a cylindrical one, and of the threads of a conical screw making variable angles with the axis; but the taper or angle of the cone requires to be but very small, being determined by the modulus of elasticity of the stone to be split, which in all rocks commonly met with is very low; so that the screw being very coarse—having round threads, being very little taper, and not requiring to fit accurately—those objections are not cogent.

To use this apparatus, the jumper hole being prepared, the two segments are placed at opposite sides of it, and the screw inserted and screwed down. The friction of the stone against the back of the segments keeps them in their respective places. The screw must descend, and as it descends it must expand the segments, and by their expansion the stone is split. I have found by exper-



iment that the rock will always split in the direction of the interval between the segments; so that when a prolonged section of an homogeneous rock is required, it is easily produced by a number of such screws placed in the desired line. Omitting the consideration of the effects of friction, which, I am fully aware, are in this case very considerable, but can only be determined by experiments, it is sufficiently obvious that the power of this instrument is the same as that of a wedge employed for cleaving, whose angle is equal to that of the cone round which the screw is wrapped, urged, or driven on by the energy due to the same screw, actuated by a lever of a given length.

The power of this screw, then, is expressed by

$$P = \frac{h}{2\pi R} W.$$

where P is the power or energy of the screw; $h$ the distance between two contiguous threads; $\pi$ the constant ratio of the diameter of a circle to its circumference; R the length of the lever used; and W the power or dead weight applied.

The power of the wedge, again, is given by the equation,

$$P = \frac{R\,l\,B}{L^2}$$

P representing the energy with which the power of the screw acts against the resistance of the particles of the stone, the length from the point or extremity of the cleft or split when *first commenced*, to

that point where the resistance may be supposed concentrated against the sides of the wedge, *i. e.* the screw segments; and L the length of the cleft when first commenced. It is obvious, that R, *l*, and L, vary with different kinds of stone, and are constant with each particular kind; whence, for want of experimental data, it is impossible at present to reduce these equations to figures.—The friction, too, of the instrument increases in a greater ratio than the pressure, from the continually increasing difference between the threads of the conical male screw and those of the cylindrical female screw.

So far, it will be admitted, I have not slurred over the difficulties and disadvantages to which the machine is exposed; but I have tried it, and the result of one experiment, at which the whole of the Commissioners of Public Works in this county, Mr. Vignoles, the engineer, of Liverpool, and Mr. John M'Mahon, of the firm of Henry Mullens & M'Mahon, were present, and expressed their entire satisfaction, will suffice.

Two men, with a lever of only *three feet in length*, and a single screw and segments of the size before described, split a mass of the argillaceous lime-stone of the county of Dublin, (*Calp* of Kirwan,) weighing nearly a ton, in 17 revolutions of the screw, made in about 25 or 30 sec. The men did not put forth their strength, but merely walked round the stone, which was split contrary to its stratification, and exactly in the line of separation of the segments. The sufficiency of the power is thus clearly shown.

Mr. John M'Mahon has informed me by note, that 'he considers it a very great improvement in the art of quarrying.'

This instrument is more particularly applicable to slate quarrying, and for the purpose of obtaining great tabular masses of granite, sienite, or other very hard and homogeneous rocks. In the former application, the saving of slate, and of labor in clearing the *face* of slate-rock of the accumulating rubbish shook down by the method of blasting, recommend it. In the latter, the saving of labor, the certainty of the direction of the fracture, and the capability of splitting larger blocks than have been as yet attempted by wedges. It may be also applied to raising stratified rocks from their beds, and as a substitute for blasting in general. The jumper holes usually used for the granite of this county are three inches in diameter, and sometimes *sixteen feet* deep. Each of these screws only requires a jumper hole of nine inches deep, and three inches diameter, and *no gunpowder;* and it is hardly questionable but that 20 of these screws, requiring *less* labor of preparation, would produce a greater effect than the one blast, besides producing it in a predetermined direction.

There is another advantage of these screws over blasting, that they are free from danger to the workmen employed in using them. There is but one way that I am aware of in which it is possible for them to fail, namely, by the threads of the screw splitting off; but

the force required to strip a steel screw of one-fourth of an inch round thread, in depth and width, when twelve or fourteen threads are engaged at once, is enormous; and when a number of screws are in action on one mass of rock, the force on any individual screw need not be great.

The first cost of such screws is not very great. The male or conical screws, being of hardened steel, will last a long time; and the segments are cheaply made, when once the mould is prepared, as they wear out or are broken. The cost of jumpers is less than for blasting purposes, as they are so much shorter. It is obvious, also, that these screws may be applied at the bottom of a fissure or jumper hole, as well as near the surface of the rock, by having the head of the screw properly prolonged

Oil and black lead should be used to lubricate the screw during its descent. If a cast iron segment should break in the hole during the descent of the screw, it does not matter, as the pieces are still held by friction in their relative situations. The saving in gunpowder and labor alone, in such a place as the Bangor slate quarries, would pay the cost of some thousands of these screws, should they be found to succeed, in a few months I should suppose.

## QUESTION.

It is said that the turning gates of the Dry-Dock sustain a pressure at high water of 800 tons. I would ask some of your correspondents how this pressure is calculated; whether we measure back from the gates one, two, three, four or five feet, or whether we take the whole extent of the ocean.

THE

# YOUNG MECHANIC.

## SEPTEMBER, 1833.

## CHEMISTRY.

### WATER.

Rain Water.—No natural water exists in a state of absolute purity; that which approaches the nearest to it is rain water. This always contains air and carbonic acid;* nitric and hydrochloric acids, and lime, have also been detected.† Beside these it contains numerous other foreign substances, which, previous to the shower, were floating in the air, and which combine with it while falling to the earth. In some instances the quantity and appearance of these substances has been such as to attract particular notice, alarming the fears of the superstitious, and giving rise to many marvellous reports, such as the raining of blood, dust, stones, &c. The presence of these substances is to be attributed in most cases to wind, and in some, to volcanic eruptions. The red snow of the Alps has attracted considerable attention, and careful analysises have been made, from which it is inferred that its color is owing to a red vegetable matter. In some specimens the presence of per-oxide of iron is sufficient to account for this peculiarity.

Mineral Waters.—Great differences exist, in the water of different places, both in degree of purity and in the nature of the foreign substances which they hold in solution, or in suspension. Those which contain mineral substances in considerable quantity are distinguished by the general term mineral waters. They occur in

* It is remarkable that this air is very rich in oxygen; that procured from snow water, was found by Gay, Lussac and Humbolt to contain 34·8, and that from rain water 32 per cent.

† M. Liebic examined 77 specimens of rain water, 17 of which were produced during storms; all the latter contained nitric acid in different quantities.

different parts of the earth, constituting wells, springs, or fountains, many of which attracted the attention of mankind at a very early period, and were then, as now, employed both externally and internally for the cure of diseases. Beside great differences in their composition, there is a great diversity in their temperature, some being the same as surrounding bodies, while in others it is as high as 212° F.

In nearly all mineral waters there is some substance, which from its greater activity or quantity, gives a character to the water; this has occasioned a division into the following classes.

1. *Acidulous Waters.*—These contain a considerable proportion of *carbonic acid* in a free state; they may be distinguished by their acid taste.

2. *Chalybeate Waters.*—These contain *iron*, usually held in solution by carbonic acid. They possess a strong styptic taste, and are blackened by an infusion of nutgalls. In waters of this class the carbonic acid is sometimes in such excess as to commucate acid properties forming a sub-division called *Acidulous Chalybeate.*

3. *Hepatic* or *Sulphureous Waters.*—These contain *sulphuretted hydrogen*, most frequently uncombined; they are easily distinguished by their smell, and by the property which this gas possesses, of blackening silver and lead.

4. *Saline Waters.*—These contain only salts in solution. They contain no free-carbonic acid, sulphuretted hydrogen or iron.

The following is a list of substances hitherto found in mineral waters.

1. Air,
2. Oxygen,
3. Nitrogen,
4. Carbonic acid,
5. Sulphureous acid,
6. Boracic acid,
7. Sulphuret'd hydrogen,
8. Soda,
9. Silica,
10. Lime
11. Sulphate of Soda,
12. " of Ammonia,
13. " of Lime,
14. Sulphate of Magnesia,
15. " of Alumina,
16. " of Iron,
17. " of Copper,
18. Nitrate of Potash,
19. " of Lime,
20. " of Magnesia,
21. Muriate of Potash,
22. " of Soda,
23. " of Ammonia,
24. " of Baryta,
25. " of Lime,
26. " of Magnesia,
27. Muriate of Alumina,
28. " of Manganese,
29. Carbonate of Potash,
30. " Soda,
31. " of Ammonia,
32. " of Lime,
33. " of Magnesia,
34. " of Alumina,
35. " of Iron,
36. Hydrosulphuret of Lime,
37. " of Potash,
38. Borate of Soda.

Beside the substances above enumerated, animal and vegetable matters are also occasionally to be met with in mineral waters, but these may be considered as accidental.

The following description of some of the principal mineral waters, which have been subjected to examination, will serve to show their uses and importance, and also the salts which most commonly associate in them. The importance of an investigation of the various waters of the globe will be admitted, when we consider that not only the quality of the articles prepared by numerous manufactures, but the differences observable in the salubrity of different places, are in a great degree dependant upon the quality of

the water consumed; and that it is to such investigations that many of us are indebted for our health or our lives, and many cities and villages for their wealth and prosperity.

Aix-la-Chapelle or *Aken Waters.*—The thermal or warm sulphureous waters of the city of Aix-la-Chapelle in Germany, have long held a distinguished place among the mineral springs of Europe, and have contributed considerably to the opulence and celebrity of the place. The principal spring is enclosed in a square stone cistern the upper part of which is vaulted, and contracted in its dimensions. A considerable quantity of sulphur sublimes from the water and collects upon the upper part of the cistern in the form of fine powder, from whence it is, from time to time, collected and sold under the name of *Aix Sulphur.* The temperature of the water is about 143° Fah. When fresh from the spring it is clear, and possesses a strong sulphurous and foetic odor; but upon standing it loses its smell, becomes turbid, and deposits a calcareous sediment. It is soft to the touch and somewhat saponaceous, producing lather to a slight degree when agitated. The effects of this water as a medicine, are very striking. Its immediate operation when drank in moderate quantity raises the spirits. It afterwards proves diuretic, and increases perspiration. It is used also externally as a bath to soften the rigidity left by gout and rheumatism, to stimulate cold and paralytic limbs, and for the cure of many cutaneous disorders. Its saponaceous quality, and more particularly its temperature, render it valuable for fulling and cleansing wool and linen, and other processes in art where water is required.

The following is Bergman's analysis of the Aix-water:

| | |
|---|---|
| Water, | 8910, |
| Sulphuretted hydrogen, | 13·06, cub. in. |
| Carbonate of Soda, | 15·25, |
| " of Lime, | 5·93, |
| Muriate of Soda, | 6·21. |

This water has been imitated by passing sulphuretted hydrogen gas through a hot and very weak alkaline water.

Balaruc Waters.—These are hot springs of some celebrity in the town of Balaruc in France. They are limpid and saltish to the taste. Their temperature is about 128° Fah. They belong to the class of saline thermal waters, and are used both externally and internally for the cure of diseases.

One thousand grains contain, according to Orfila,

| | |
|---|---|
| Carbonic Acid, | 36 cub. in. |
| Carbonate of Lime, | 7 gr. |
| " of Magnesia, | 0·55, |
| Hydrochlorate of Soda, | 45·05, |
| " of Lime, | 5·45, |
| " of Magnesia, | 8·25, |
| Sulphate of Lime, | 4·20. |
| A trace of Iron, | |

Bath Waters.—The city of Bath, in Somersetshire, England, has long been celebrated for its saline thermal waters. There are three principal sources affording an abundant and invariable supply. The temperature of the hottest of these is uniformly 116°, and that of the coldest 112° F., and they remain the same during the year. The taste of Bath water is simply hot and chalybeate, and what is remarkable is, that it loses this taste upon standing before any sensible precipitation of the iron takes place. The diseases for which it has been recommended are numerous. As a remedy for the gout, rheumatism paralysis of the limbs, and diseases of the urinary organs, it has long been celebrated. Its external application may be traced back to a very early period ; by some it is pretended to have been in use 800 years before Christ.

In an alnalysis by Mr. Phillips, one pint was found to contain

| | |
|---|---|
| Carbonic Acid, | 1·2 cub. in. |
| Sulphate of Lime, | 9 grains, |
| Hydrochlorate of Soda, | 3·3 " |
| Sulphate of Soda, | 1·5 " |
| Carbonate of Lime, | 0·8 " |
| Silex, | 0·2 " |
| Oxide of Iron, | 0·0147 " |

Brighton Water.—The town of Brighton, England, says a celebrated writer, 'may attribute its popularity to Dr. Richard Russell, who having settled here, wrote a treatise on the importance of sea-bathing, and successfully recommended the practice in scrophulous and glandular complaints. He caused a valuable mineral spring at Wick, about one mile from the place, to be opened, &c.'

This spring is chalybeate, and according to Dr. Marcet one pint contains

| | |
|---|---|
| Carbonic Acid, | 2·5 cub. in. |
| Sulphate of Iron, | 1·80 gr. |
| " of Lime, | 4·09, |
| Hydrochlorate of Soda, | 1·53, |
| " of Magnesia, | 0·75, |
| " of Silex, | 0·14, |
| Loss, | 0·19 |

Bristol Hotwells.—A simple thermal water in the city of Bristol, England. It is without odor, perfectly limpid and sparkling, and sends forth air-bubbles when poured into a vessel. Its specific gravity is 1·00077. The temperature upon an average is about 74° F. It was formerly much celebrated in consumption, but its beneficial effects in this disease have been justly called in question. According to Dr. Carrick's analysis one pint contains

| | |
|---|---|
| Carbonic Acid, | 3·75 cub. in. |
| Air, | 0·375 " " |
| Hydrochlorate of Magnesia, | 0·9 grains, |
| " of Soda, | 0·5 " |
| Sulphate of Soda, | 1·4 " |
| " of Lime, | 1·47 " |
| Carbonate of Lime, | 1·63 " |

Buxton Waters.—The town of Buxton, in Derbyshire, England, has been much celebrated for its mineral waters for more than two hundred years, and has been for that period resorted to by large numbers on this account. Indeed, from the ruins of an ancient bath and some capacious leaden cisterns which have been found there, it is apparent that they were in use at a very early period, though there is no record of their being in use in the middle ages. The waters are now conveyed from the springs into baths in a building constructed for the purpose. The springs, it is estimated, throw up about sixty gallons of water every minute. A white marble basin called St. Anne's Well, is resorted to, usually, to obtain the water for drinking; it is remarkable from the circumstance that hot and cold spring water may be obtained, within one foot of each other, from a double pump, in the building which contains it. The Buxton water is perfectly clear and colorless, entirely void of smell and nearly of taste. The temperature is about 82° F. uniformly in all seasons. It possesses, notwithstanding its celebrity, no remarkable medicinal properties. It is employed largely both externally and internally. Its temperature and the great abundance of the supply, render it of great value as a bath. It is used for cooking and other domestic purposes at the houses in the vicinity. Its composition, according to Dr. Pearson, is,

| | |
|---|---|
| Water, | 58309 gr. |
| Nitrogen, | 2 cub. in. |
| Carbonate of Lime, | 10·5 gr. |
| Sulphate of Lime, | 2·5, |
| Hydrochlorate of Soda, | 1·5. |

Carlsbad or Caroline Waters.—These very celebrated and singular acidulo-chalybeate thermal springs are situated in Carlsbad, Bohemia. There are several springs within a small compass, of which the principal one, called the *Prudel* (or furious) issues out violently, in large quantity, through a natural vault or incrustation of stalactite which it has formed by long deposition. The temperature of this fountain is invariably 165° F. Some of the other springs are only 120° to 125° Fah. The taste of the water is strongly alkaline, bitter, and strongly chalybeate. It has scarcely any odor. This water is remarkable for a very rapid deposition of carbonate of lime as it cools, which forms a very hard incrustation upon wood, moss, and other articles which are exposed to it for that purpose, and will afterwards sustain a high polish, presenting a variegated surface, occasioned by the iron precipitating with the carbonate of lime, which is very beautiful. The Carlsbad waters, beside their use in the cure of disorders, are valuable for the salt which they contain. The only one, however, which is manufactured from them is sulphate of soda. According to Dr. Beecher's estimate, the main spring alone throws out annually, equal to 746,864 lbs. crystallized carbonate of soda, 1,132,923 lbs. crystallized sulphate of soda, and 238,209 lbs. crystallized muriate of soda.

Klaproth's analysis of water from the principal spring is as follows: 100 cubic inches contain

| | |
|---|---|
| Carbonate of Soda, (dry,) | 39 gr. |
| Sulphate of Soda, | 70·5, |
| Muriate of Soda, | 34·1, |
| Carbonate of Lime, | 12, |
| Silex, | 2·5, |
| Oxide of Iron, | 0·1, |
| Carbonic Acid, | 32 cub: in. |

Cheltenham Waters.—To these waters, the town of Cheltenham, England, probably owes more of its celebrity than to any other circumstance. The medicinal properties of the water were discovered in the year 1716, since which time its beneficial effects have proved an increasing source of wealth to the place. Salts are obtained from it and sold under the name of *Cheltenham salts.* It is a saline chalybeate water, and its composition, according to Fothergill, is as follows,

| | |
|---|---|
| Water, | 103643 gr. |
| Carbonic Acid, | 30·368 cub. in. |
| Nitrogen, | 15 " " |
| Carbonate of Iron, | 5, |
| Hydrochlorate of soda, | 5, |
| " of Magnesia and Sulphate of Magnesia, | 25, |
| Sulphate and Carbonate of Soda, | 430, |
| Sulphate of Lime, | 40, |

Hampstead Water.—This is a chalybeate spring in Hampstead, England, and was formerly much celebrated. According to Mr. Bliss, one gallon contains

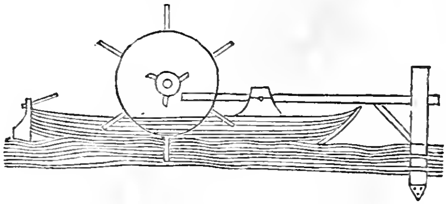
| | |
|---|---|
| Carbonic Acid, | 10·1 cub. in. |
| Air, | 90·9 " " |
| Oxide of Iron, | 1·5 grains, |
| Hydrochlorate of Magnesia, | 1·75, |
| Sulphate of Lime, | 2.12, |
| Hydrochlorate of Soda, | 1·, |
| Silex, | 0·33, |

Harrowgate Waters.—There are several saline sulphureous springs in the town of Harrowgate, England, which from their medicinal properties have given to it considerable publicity. One of them discharges, the most strongly impregnated, sulphurous water of any in the kingdom, and is much used as a bath for dropsical, scorbutic and cutaneous disorders. The composition of the two principal springs is a follows:

| *Old Well Temp.* 69° *F.* | | *Oddie's Temp.* 50° *F.* | |
|---|---|---|---|
| Carbonic Acid, | 65 cub. in. | Carbonate Soda, | 84 gr. |
| Sulphuretted hydrogen, | 8, | " of Magnesia, | 1, |
| Nitrogen, | 8, | Sulphate of Lime, | 23, |
| Carburretted hydrogen, | 58, | Hydrochlorate of Soda, | 37·5, |
| Carbonate of Soda, | 1·84, gr. | " of Lime, | 2·75, |
| Hydrochlorate of Soda, | 9·2, | " of Magnesia, | 1·23, |
| " of Lime, | 8·9, | Oxide of Iron, | 3, |
| " of Magnesia, | 5·4, | Total of Saline matter, | 42·95. |
| Total of Saline matter, | 103·14, | | |

## REMOVING ROCKS FROM RIVERS.

Amongst natural operations perpetually altering the surface of our globe, there are some which it would be advantageous to accelerate. The wearing down of the rocks which impede the rapids of navigable rivers is one of this class. A very beautiful process for accomplishing this object has been employed in America. A boat is placed at the bottom of the rapid, and kept in its position by a long rope, which is firmly fixed on the bank of the river near the top. An axis, having a wheel similar to the paddle-wheel of a steamboat fixed at each end of it, is placed across the boat; so that the two wheels and their connecting axis shall revolve rapidly, being driven by the force of the passing current. Let us now imagine several beams of wood shod with pointed iron fixed at the ends of strong levers, projecting beyond the bow of the boat, as in the annexed representation:



If these levers are at liberty to move up and down, and if one or more projecting pieces, called cams, are fixed on the axis opposite to the end of each lever, the action of the stream upon the wheels will keep up a perpetual succession of blows. The sharp-pointed shoe, striking upon the rock at the bottom, will continually detach small pieces, which the stream will immediately carry off. Thus, by the mere action of the river itself, a constant and most effectual system of pounding the rock at its bottom is established. A single workman may, by the aid of a rudder, direct the boat to any required part of the stream; and when it is necessary to move up the rapid, as the channel is cut, he can easily cause the boat to advance by means of a capstan.

When the object of the machinery just described has been accomplished, and the channel is sufficiently deep, a slight alteration converts the apparatus to another purpose almost equally advantageous. The stampers and the projection pieces on the axis are removed, and a barrel of wood or metal, surrounding part of the axis, and capable, at pleasure, of being connected with or disconnected from the axis itself, is substituted. The rope which hitherto fastened the boat is now fixed to this barrel; and if the barrel is loose upon the axis, the paddle-wheels make the axis only revolve, and the boat remains in its place: but the moment the

axis is attached to its surrounding barrel, this begins to turn, and winding the rope upon itself, the boat is gradually drawn up against the stream, and may be employed as a kind of tug-boat for all the vessels which have occasion to ascend the rapid. When the tug-boat reaches the summit, the barrel is released from the axis, and friction being applied to moderate its velocity, the boat is allowed to descend.

BABBAGE.

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## IGNIS FATUUS.

The first time I saw the Ignis Fatuus, or Will-with-the-Wisp, was in a valley in the Forest of Gorbitz, in the Newmark. This valley cuts deeply in compact loam, and is marshy on its lower part. The water of the marsh is ferruginous, and covered with an iridescent crust. During the day bubbles of air were seen rising from it, and in the night blue flames were observed shooting from and playing over its surface. As I suspected that there was some connexion between these flames and the bubbles of air, I marked during the day-time where the latter rose up most abundantly, and repaired thither during the night; to my great joy I actually observed bluish purple flames, and did not hesitate to approach them. On reaching the spot they retired, and I pursued them in vain; all attempts to examine them closely were ineffectual. Some days of very rainy weather prevented further investigation, but afforded leisure for reflection on their nature. I conjectured that the motion of the air on my approaching the spot, forced forwared the burning gas, and remarked, that the flame burned darker, when it was blown aside; hence I concluded that a continuous thin stream of inflammable air was formed by these bubbles, which, once inflamed, continued to burn—but which, owing to the paleness of the light of the flame, could not be observed during the day.

On another day, in the twilight, I went again to the place, where I awaited the approach of night: the flames became gradually visible, but redder than formerly, thus showing that they burnt also during the day: I approached nearer, and they retired. Convinced that they would return again to the place of their origin when the agitation of the air ceased, I remained stationary and motionless, and observed them again gradually approach. As I could easily reach them, it occured to me to attempt to light paper by means of them, but for some time I did not succeed in this experiment, which I found was owing to my breathing. I therefore held my face from the flame, and also interposed a piece of cloth as a screen; on doing which I was able to singe paper, which became brown colored and covered with a viscous moisture. I next used a narrow slip of paper, and enjoyed the pleasure of seeing it take fire. The gas was evidently inflammable, and not a

phosphorescent luminous one, as some have maintained. But how do these lights originate? After some reflection I resolved to make the experiment of extinguishing them. I followed the flame; I brought it so far from the marsh, that probably the thread of connexion, if I may so express myself, was broken, and it was extinguished. But scarcely a few minutes had elapsed, when it was again renewed at its source (over the air bubbles) without my being able to observe any transition from the neighboring flames, many of which were burning in the valley. I repeated the experiment frequently, and always with success. The dawn approached, and the flames, which to me appeared to approach nearer to the earth, gradually disappeared.

On the following evening I went to the spot, and kindled a fire on the side of the valley, in order to have an opportunity of trying to interflame the gas. As on the evening before, I first extinguished the flame, and then hastened with a torch to the spot whence the gas bubbled up, when instantaneously a kind of explosion was heard, and a red light was seen over eight or nine square feet of the surface of the marsh, which diminished to a small blue flame, from two and a half to three feet in height, that continued to burn with an unsteady motion. It was therefore no longer doubtful that this ignis fatuus was caused by the evolution of inflammable gas from the marsh.

In the year 1811, I was at Malapane, in Upper Silesia, and passed several nights in the forest, because ignis fatui were observed there. I succeeded in extinguishing and inflaming the gas, but could not inflame paper or thin shavings of wood with it. In the course of the same year I repeated my experiments in the Konski forests, in Poland. The flame was darker colored than usual, but I was not able to inflame either paper or wood shavings with it; on the contrary, their surface became speedily covered with a viscous moisture.

In the year 1812, I spent half a night in the Rubenzahl Garden, on the ridge of the Reisengebrige, close on the Schneekoppe, which constantly exhibits the Will-with-the-Wisp, but having a very pale color. The flame appeared and disappeared, but was so mobile that I could never approach sufficiently near to enable me to set fire to any thing with it.

In the course of the same year I visited a place at Walkenried, in the Hartz, where these lights are said always to occur; they were very much like those of the Newmark, and I collected some of the gas in a flask. On the day after, I found by experiment that it occasioned cloudiness in lime water, a proof of its containing carbonic acid.

I observed accidentally another phenomenon allied to this, at the Porta Westphalica, near Minden. On the third of August, 1814, we played off a fire-work from the summit, to which we had ascended during the dark, and where no ignis fatuus was visible.

But scarcely had we fired off the first rocket, when a number of small red flames were observed around us below the summit, which, however, speedily extinguished—to be succeeded by others on the firing of the next rocket.

These facts induced me to separate the ignis fatui from the luminous meteors, and to free them from all connexion with electricity. They are of a chemical nature, and become inflamed on coming to the atmosphere, owing to the nature of their constitution.

I think it highly probable that the fires that sometimes break out in forests are caused by these lights.

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## PATENTS FOR MASSACHUSETTS.

*Granted in January, 1833.*

From the Journal of the Franklin Institute.

For *Making Pads for Harness, &c.;* Silas Lamson, Sterling, Worcester county, Massachusetts, January 5.

A rod of iron bent into a curved, or crescent-like, form, is to have perforations at each end to receive the terrets, and attach it to the pad. The object of this contrivance is to keep the centre, or connecting part of the pads from the back and withers of the horse, so as by throwing the weight on each side to prevent injury to the ridge of the horse's back. This connecting rod may, it is said, be bent in any desired curve, and instead of iron, other metals may be used. There is no claim made, nor does one appear to be necessary in the present case, as nothing more is described than the thing intended to be patented.

For an improvement in *Machines for Spinning Cotton;* John A. Bradshaw, Foxboro', Norfolk county, Massachusetts, January 18.

In arrangement there is certainly some difference between the spindle which is the subject of this patent, and others previously patented both here and in England, but in principle we cannot discover the slightest. There is a dead spindle with revolving flyers, the spindle is raised and lowered by means of a wave rail, in the usual manner, and it consists of three parts; the lower part reaches up to the lower end of the bobbin; this is drilled down to the depth of five or six inches, to receive a wire which is adapted to it; upon this wire, which projects some inches above the lower section of the spindle, is placed the upper section, drilled also for that purpose; and upon this the bobbin is to be placed. The whirl and shaft of the flyer, which revolves freely on the spindle, is driven in the usual way. Those who are acquainted with the recent improvements in spinning, will at once perceive the identity of action in this and some other spindles.

For *Cast Iron Hubs for Wheels;* Carver Washburn, Bridgewater, Plymouth county, Massachusetts, January 18.

This patent is taken simply for the insertion of ferules, or boxes, of metal of a suitable composition, within the ends of cast iron hubs, and the confining them there by screws. The boxes, it is observed, may be renewed when worn, and that they thus remove the objection of the wearing out of cast iron hubs by the friction of the axletree.

Would not a better mode of removing this objection be the case hardening of the axles? It is well known to mechanists that cast iron and hard steel run with less friction than most other metals, and that lathe collars of cast iron, with hard steel mandrels, wear as little, or less, than hardened steel when used for both.

For an improvement in the mode of *Caking Sugar;* Uriel Smith, Sandisfield, Berkshire county, Massachusetts, January 21.

We are somewhat in the dark about the business of *caking sugar*, and find nothing to enlighten us in the specification; we have concluded, however, that the design is to form maple sugar into cakes in a way more convenient than that hitherto employed. The moulds, it seems, are to be made square, of wood, or metal, and are to be arranged in a square frame. Their sides are to be sloping, that the cake, when formed, may be the more readily removed. This is all we can gather from the description, and lest we might plunge into some fatal error upon the subject, we shall leave all further inferences to be drawn by those who may choose to occupy themselves in this matter.

For a *Felt Washer;* William Cole, Lee, Berkshire county, Massachusetts, January 23.

The felt washer here described consists of a wheel carrying four rounds, like those of a reel. The length of the wheel must be equal to the width of the felt, against the lower side of which it is made to revolve in a direction the reverse of that in which the felt passes, the rounds bearing forcibly against it. A tube of tin, or other metal, is placed on the side of the felt opposite to the revolving washer; a row of holes, contiguous to each other, is made along the side of the tube which presses against the felt, and water being let into this tube, it is discharged through these openings upon the felt. This arrangement, the patentee says, will serve to keep the felt perfectly clean until it is worn out.

For a *Mode of Opening, Closing, and Fastening Window Blinds;* Edwin Keith, Bridgetown, Plymouth county, Massachusetts, January 25.

The contrivance here patented is intended to enable a person to open and close blind shutters, and to cause them to stand at any angle required, without the necessity of raising the window sash. Upon the lower end of the hinged side of the blind, a toothed circular segment is to be firmly fixed, the hinge joint, or pin, being the centre of the circle. An iron shaft which passes through the window frame has an endless screw on its outer end, the threads of which take into the toothed segment. By turning this

on the inside, the blinds may be opened and closed at pleasure.— The claim is to this mode of effecting the object, with the variations of which it is susceptible.

The only objection which we perceive to this plan, is, that, in windy weather, the force upon the segment will be very great, in consequence of its nearness to the fulcrum. To obviate this objection, it would be necessary to make it inconveniently large.

For a machine for *Drilling the Eyes of Axes;* Milton Dexter Whipple, Douglass, Worcester county, Massachusetts, January 31.

This appears to be a well arranged machine, the object of which is the making the eyes of axes perfectly true, and of a size, by means of a drilling or boring apparatus of a peculiar construction. The patent is taken for the machine *as described*, the idea of boring, or drilling the eyes, not being considered as new. The patent taken by Benjamin Smith, on the second of November last, is, in part, for an apparatus for drilling the eyes of axes, but the two do not resemble each other. As the present machine is complex, and dependent altogether upon its peculiar construction, it would require an engraving for its clear explanation.

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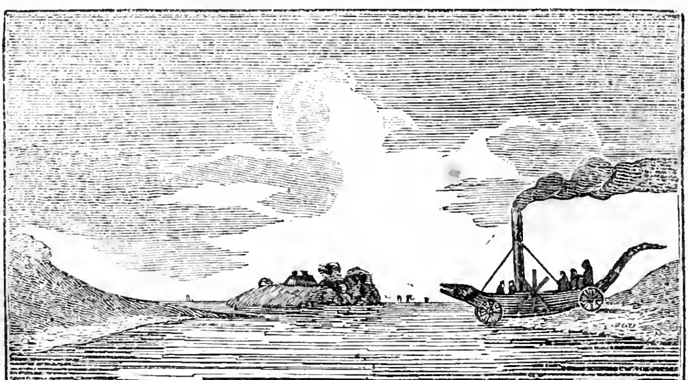
For the Young Mechanic.

## AMPHIBIOUS STEAMER.

Steamer Alligator entering the water.



In the last number of the Young Mechanic, I gave a brief description of a Steamer, which I suppose might answer for both land and water. I now send you a drawing to illustrate the thing more clearly. The name I have adopted is the Alligator, and have endeavored to give it somewhat the form of that animal.

PHILO.

## GEOMETRY AND ARITHMETIC.

[Continued from page 122.]

### DECIMAL FRACTIONS.

A decimal fraction has always unity, or one, for its denominator, with as many cyphers annexed as there are places in the fraction; a unit may be supposed to be divided into 10 parts, these will be tenths of a unit; a tenth may be divided into 10 parts, these will be hundredths of a unit; a hundred may be divided into 10 parts, and these will be thousandth parts of a unit; this subdivision may be extended indefinitely.

To express 1-2, the unit need only be divided into 10 parts: 5 tenths equal 1-2.

To express 1-4, the unit must be divided into 100 parts: 25 hundredths equal 1-4.

To express 1-8, the unit must be divided into 1,000 parts: 125 thousandths equal 1-8.

To express 1-16, the unit must be divided into 10,000 parts: 625 10 thousandths equal 1-16th.

Hence the necessity of the unit being divided into very small parts, in order to express some fractions; indeed there are fractions which cannot be expressed exactly by the decimal scale: for this reason many instruments are divided decimally, for when dimensions are taken by a decimal scale, there is no difficulty in expressing the fractions accurately. Decimal fractions are of such a nature, that they vary in the same proportion, and are managed by the same method of operation, as whole numbers are.

All the operations in arithmetic are performed with 10 characters, only 9 of which are significant, or have any value of their own; the cypher is used only to preserve the others in their proper places; they express a value according to their shape, and also their distance from a certain point; it is necessary that this point, or starting place, should be well understood; this point is the unit's place, or right hand figure, where a figure has its simple value according to its shape, but it increases in a tenfold ratio as often as it is removed one place further towards the left hand, thus 8 becomes 80—800, &c., so that any number may be expressed by these 10 characters, however large it may be. But these same 10 characters are made to express parts of a unit, no matter how small the part may be, for as a figure increases in value as it is carried to the left hand, so it must decrease in the same ratio if it be removed to the right. It may be asked, If we put figures to the right of the unit's place, how can we tell which is the unit's figure? this is done by placing a mark between the unit's figure and the first figure of the fraction; thus, if I wish to express $\frac{1}{4}$

decimally, I put a cypher for the unit's place, then a period as a mark, then 2 tenths, then 5 hundredths, thus, 0·25, and call it 25 hundredths, or 1 fourth.

The names of the several places in which the figures stand depend upon their distance to the right or left from the decimal point, and may be understood from the following

TABLE.

| Millions. | 100 Thousands. | 10 Thousands. | Thousands. | Hundreds. | Tens. | Units Place. | Decimal Point. | Tenths place. | Hundredths. | Thousandths. | 10 Thousandths. | 100 Thousandths. | Millionths. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 7 | 6 | 5 | 4 | 3 | 2 | 1 | . | 2 | 3 | 4 | 5 | 6 | 7 |

## ADDITION OF DECIMALS.

Addition and Subtraction in decimals are performed in the same manner as whole numbers, care being taken that like parts be placed under one another, and from their sum, or difference, point off as many places for decimals as are equal to the greatest number of decimal places in any of the given numbers.

EXAMPLES.

| | | |
|---|---|---|
| 19·025 | 1·0625 | 123·534 |
| 7·603 | ·31 | 5·6 |
| ·542 | ·246 | ·75 |
| $27·170 | lbs. 1·6185 | galls. 129·884 |

## SUBTRACTION OF DECIMALS.

EXAMPLES.

| | | |
|---|---|---|
| 27·025 | 1·75 | 15·5 |
| 19·673 | ·67 | 7·75 |
| ozs. 7·352 | inch. 1·08 | ft. 7·75 |

## MULTIPLICATION OF DECIMALS.

RULE.—Proceed as in multiplication of whole numbers; then point off as many places of the product for decimals as there are decimals in both the multiplicand and multiplier; but if the product does not consist of as many places, the deficiency must be supplied by prefixing cyphers.*

EXAMPLES.

| | |
|---|---|
| Multiply 6·25 | Multiply 1·625 |
| by ·25 | by ·037 |
| 3125 | 11375 |
| 1250 | 4875 |
| Ans. 1·5625 | Ans. ·060125 |

## DIVISION OF DECIMALS.

RULE.—1. Proceed as in division of whole numbers; then point off as many places of the quotient for decimals as the dividend has decimal places more than the divisor.

2. If the places of the quotient be not as many as the rule requires, supply the defect by prefixing cyphers to the left hand.

3. If at any time there be a remainder, or the decimal places in the divisor be more than those in the dividend, cyphers may be annexed to the dividend or to the remainder, and the quotient carried on to any degree of exactness.

EXAMPLES.

(1.) 8)231·000 inches in a wine gall.

28·875 inches in a wine pint.

(2.) 8)2150·4 inches in a bushel.

268·8 inches in a dry gall.

(3.) 2.76)23·30625(8 475 quotient.

```
2200
----
 1306
 1100
 ----
  2062
  1925
  ----
   1375
   1375
```

In this example, there being three places of decimals in the dividend *more* than in the divisor, I point off the three right hand figures of the quotient, viz.: ·475 for decimals, according to Rule 1.

(4.) 12)0·64896(0·05408 quotient.

```
60
--
 48
 48
 --
  96
  96
```

In this example, there being not so many places in the quotient as there are decimals in the dividend, the defect is supplied by prefixing one cypher, according to Rule 2.

The 4th example may be done by short division, thus: { 12)0·64896 / 0·05508

## REDUCTION OF DECIMALS.

*To reduce a Vulgar Fraction to its equivalent Decimal.*

RULE.—Divide the numerator by the denominator, and the quotient will be the decimal required. Or, so many cyphers as you annex to the given numerator, so many places must be pointed off in the quotient; and if there be not so many places of figures in the quotient, the deficiency must be supplied by prefixing so many cyphers before the quotient figures.

EXAMPLES.

1. Reduce 1-8 to a decimal. 8)1·000

0·125 Ans.

2. Reduce 3-8, 5-8, and 2-3 to decimals. Ans. ·375 ·625 ·666+.

*To reduce a decimal to its lowest terms.*—Cast off the cyphers from the right hand.

*To reduce decimals to the lowest denomination.*—Annex cyphers so that they may all have the same number of decimal places.

---

* When cyphers are to be placed at the *left hand* of any number, they are said to be *prefixed*, but when they are to be placed at the *right hand*, they are said to be *annexed*.

*Table for reducing Vulgar Fractions to Decimal Fractions.*

| | 2nd. | 3rd. | 4th. | 5th. | 6th. | 7th. | 8th. | 9th. | 10th. | 11th. | 12th. | 13th. | 14th. | 15th. | 16th. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0·5 | 0·333 | 0·25 | 0·2 | 0·166 | 0·142357 | 0·125 | 0·111 | 0·1 | 0·0909 | 0·083 | 0·0769 | 0·071428 | 0·066 | 0·0625 |
| 2 | 1·0 | 0·666 | 0·5 | 0·4 | 0·333 | 0.285714 | 0·25 | 0·222 | 0·2 | 0·1818 | 0·166 | 0·1538 | 0·142857 | 0·133 | 0·125 |
| 3 | | 1·000 | 0·75 | 0·6 | 0·5 | 0·423571 | 0.375 | 0·333 | 0·3 | 0·2727 | 0·25 | 0·2307 | 0·214285 | 0·2 | 0·1875 |
| 4 | | | 1·0 | 0·8 | 0·666 | 0·571428 | 0·5 | 0·444 | 0·4 | 0·3636 | 0·333 | 0·3076 | 0·285714 | 0·266 | 0·25 |
| 5 | | | | 1·0 | 0·833 | 0·714285 | 0·625 | 0·555 | 0·5 | 0·4545 | 0·416 | 0·3846 | 0·357142 | 0·333 | 0·3125 |
| 6 | | | | | 1·000 | 0·857142 | 0.75 | 0·666 | 0·6 | 0·5454 | 0·5 | 0·4615 | 0·428571 | 0·4 | 0·375 |
| 7 | | | | | | 1·000000 | 0·875 | 0·777 | 0·7 | 0·6363 | 0·583 | 0·5384 | 0·5 | 0·466 | 0·4375 |
| 8 | | | | | | | 1·000 | 0·888 | 0·8 | 0·7272 | 0·666 | 0·6153 | 0·571428 | 0·533 | 0·5 |
| 9 | | | | | | | | 1·000 | 0·9 | 0·8181 | 0·75 | 0·6923 | 0·642857 | 0·6 | 0·5625 |
| 10 | | | | | | | | | 1·0 | 0·9090 | 0·833 | 0·7692 | 0·714285 | 0·666 | 0·625 |
| 11 | | | | | | | | | | 1·0000 | 0·916 | 0·8461 | 0·785714 | 0·733 | 0·6875 |
| 12 | | | | | | | | | | | 1·000 | 0·9230 | 0·857142 | 0·8 | 0·75 |
| 13 | | | | | | | | | | | | 1·0000 | 0·928571 | 0·866 | 0·8125 |
| 14 | | | | | | | | | | | | | 1·000000 | 0·933 | 0·875 |
| 15 | | | | | | | | | | | | | | 1·000 | 0·9375 |
| 16 | | | | | | | | | | | | | | | 1·0000 |

### EXPLANATION OF THE TABLE.

The numerators are in the first or left hand column. And the denominators are placed at the tops of the other columns. In a line with the numerator and under the denominator, is the quivalent decimal fraction, thus: 9-12ths.=0·75; and 6-16ths.=0·375.

PHILO.

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## QUESTIONS.

Supposing a hole one foot diameter, to be made entirely through the earth, in the latitude of the State House, Boston, how far beyond the centre of the earth would an ounce bullet pass, dropped from the surface, the hole being supposed to be free from water or other obstruction?

Why does thunder turn milk?

THE

# YOUNG MECHANIC.

OCTOBER, 1833.

## CHEMISTRY.

### WATER.

Malvern Waters. From the Malvern hills, Worcestershire, various springs issue, of different qualities. One, in particular, has been a long time in repute for its medicinal efficacy, and has obtained the name of *Holy-well.* According to Dr. Wilson one gallon of this water contains

| | |
|---|---|
| Carbonate of Soda, | 5·33 grains, |
| " of Lime, | 1·6, |
| " of Magnesia, | 919, |
| " of Iron, | 625, |
| Sulphate of Soda, | 2·896, |
| Hydrochlorate of Soda, | 1·553, |
| Silex, | 1·687. |

The water of St. Ann's well, from the same hills, according to Dr. Wilson, contains in one gallon,

| | |
|---|---|
| Carbonate of Soda, | 3·55 grains, |
| " of Lime, | 352, |
| " of Magnesia, | 26, |
| " of Iron, | 328, |
| Sulphate of Soda, | 1·43, |
| Hydrochlorate of Soda, | 955, |
| Silex, | 47. |

Moffat Waters. About a mile and a half from Moffat, Scotland, is situated the celebrated Moffat well. It has been held in high estimation, for nearly two centuries. According to Garnet its composition is as follows:

| | |
|---|---|
| Water, | 103643, |
| Carbonic Acid, | 1 cub. in., |
| Sulphuretted hydrogen, | 10, |
| Nitrogen, | 4, |
| Hydrochlorate of Soda, | 3·6 gr. |

Pitcaithly Waters. The town of Pitcaithly, in Scotland, has long been celebrated for its waters. There are in the place five distinct springs, all partaking of the same qualities. According to Dr. Murray, a pint of the water contains,

| | |
|---|---|
| Air, | 0·5 cub in. |
| Carbonic Acid, | 1, |
| Hydrochlorate of Soda, | 13·4, |
| " of Lime, | 19·5, |
| Sulphate of Lime, | 9, |
| Carbonate of Lime, | 5 |

Pyrmont Water. This water belongs to the class called acidulous chalybeate. It contains a large proportion of carbonic acid, and is said to sparkle like the briskest Champaigne wine when taken from the fountain, and when drank fresh to produce a degree of intoxication. It is situated in Pyrmont in Germany.

One hundred pounds of this water contain,

| | |
|---|---|
| Carbonic Acid, | 1500 gr. |
| Carbonate of Lime, | 343·75, |
| " of Magnesia, | 339, |
| " of Iron, | 105·5, |
| Hydrochlorate of Soda, | 122·0, |
| " of Magnesia, | 134, |
| Sulphate of Soda, (cryst.) | 289, |
| " of Magnesia, (cryst.) | 547, |
| Resinous Principles, | 9. |

Saratoga Waters. The Saratoga and Ballston springs, are yearly becoming more celebrated, both for their medicinal properties, and a place of fashionable resort. They are situated in the county of Saratoga, in the state of New York, and are about 7 miles distant from each other. Water from Congress spring contains,

| | |
|---|---|
| Hydrochlorate of Soda, | 297·3, |
| Hydrodate of Soda, | 3, |
| Carbonate of Soda, | 19·21, |
| " of Lime, | 92·4, |
| " of Magnesia, | 23·1, |
| Oxide of Iron, | 5·39. |

It contains also a small portion of silica, alumina, and Bromine.

Seltzer Water. This water proceeds from a spring in Lower Seltzer, about ten miles from Francfort in Germany. It is remarkably clear, possesses a smart pungent taste and discharges an abundance of air bubbles when poured from one bottle into another. It is esteemed useful in many diseases, and is much used by visitors at the spring, and the inhabitants of other places, large quantities being yearly put up for transportation. Its composition according to Bergman, is,

| | |
|---|---|
| Water, | 8949, |
| Oxygen, | 435 cub. in. |
| Carbonic Acid, | 13·068, |
| Carbonate of Soda, | 5·22 gr. |
| " of Lime, | 78·3 |
| " of Magnesia, | 6·32, |
| Hydrochlorate of Soda, | 13·74. |

Spa Waters. The spa, derives its name from the town of Spa, in France. This place is resorted to by persons from all parts of Europe, for the benefit of the water, the value of which, may be inferred from the circumstance that the town has on its account been allowed a neutrality during the hottest wars. One hundred quarts of this water contains,

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|---|---|
| Carbonic Acid, | 1080 cub. in. |
| Carbonate of Lime, | 154·5 gr. |
| " of Magnesia, | 365·5, |
| " of Soda, | 154·5, |
| " of Iron, | 55·2, |
| Hydrochlorate of Soda, | 18·2. |

Sea Water. It has been before remarked that water is one of the most abundant and extensively diffused compounds on our globe. The water of the ocean forms the principal part ; it is the great reservoir from which the water proceeds, which in the form of rain and dew fertilizes the earth. Raised by the heat of the sun into the atmosphere, and condensed upon the earth into streams, that give rise to springs and rivers, it again returns to its source. The absolute quantity of the water of the ocean cannot be ascertained, as its mean depth is unknown. On the supposition that its mean depth is not greater than one fourth part of a mile, its solid contents would not be less than 32,000,000 cubic miles. At a distance from shore it is clear, colorless, and without odor, it possesses a strong saline, and also, more particularly at its surface a nauseous and bitter taste. Its specific gravity varies in different latitudes and circumstances, from 1·0269 to 1·10285. It freezes at 28½° F. Dr. Marcet in a paper published in the Phil. Trans. for 1829, has shown that in Baffins Bay, the Mediteranean Sea, and the Tropical Seas, the temperature of the water diminishes with the depth, but in the Arctic or Greenland Seas, the temperature increases with the depth. We are indebted to Mr. Scoresby who first observed this singular circumstance, the truth of which has been more lately confirmed by the experiments of Franklin, Beechy and Fisher. It is composed of lime, magnesia, soda, sulphuric acid, hydrochloric acid, hydriodic acid, potash and ammonia, and bromine. From Dr. Murray's analysis of water collected in the Frith of Forth, we learn that a pint contains 226·1 grains of saline matter, viz. of,

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|---|---|
| Lime, | 2·9 grains, |
| Magnesia, | 14·8, |
| Soda, | 96·3, |
| Sulphuric Acid, | 14·4, |
| Hydrochloric Acid, | 97·7, |
| | 226·1. |

If we evaporate sea water, we obtain hydrochlorate of soda, and magnesia, and sulphates of magnesia and lime. Supposing therefore that the elements are thus united, its composition would be,

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|---|---|
| Hydrochlorate of Soda, | 180·5 grains, |
| " of Magnesia, | 23·0, |
| Sulphate of Magnesia, | 15.5, |
| " of Lime, | 7·1, |
| | 226·1. |

On supposing the lime to exist as hydrochlorate, and the sulphuric acid in combination with soda, which is the most probable conclusion, then the true composition of sea water will be,

| | |
|---|---|
| Hydrochlorate of Soda, | 159·3 grains, |
| " of Magnesia, | 35·5, |
| " of Lime, | 5·7, |
| Sulphate of Soda, | 25·6, |
| | 226·1. |

From the numerous experiments and observations which have been made upon the sea, we learn that the proportions of its saline contents does not differ much in different situations, and that those variations which have been observed, do not, so far as we are acquainted, follow any known rule in this respect. Between South latitude 10° and 20°, the saline contents amount to rather more than 1-24th part; between 18° and 34° north latitude, they are rather less than 1-24th, at the equator nearly 1-25th, and in north latitude 57°, but little more than 1-27th. The water of inland seas, and those bays, &c. that have fresh water rivers emptying into them, contain in general less saline matter. This is the case with the Baltic, and it has been observed that the proportion is increased by a west or north-west wind. During an east wind its specific gravity was found to be 1·0039 and during a north-west wind 1·0098. There are some seas, which differ also in their proportions of the constituents considerably from the Atlantic. The composition of the Dead sea has been given by Dr. Marcet. Its specific gravity is 1·211. One hundred parts contain,

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|---|---|
| Hydrochlorate of Lime, | 3·920, |
| " of Magnesia, | 10·246, |
| " of Soda, | 10·360, |
| Sulphate of Lime, | 0·054. |

Many attempts have been made to purify sea water so as to render it portable ; the only effectual method is to distill it and afterwards expose it to the air in shallow vessels. It is used occasionally as a cathartic in doses of about a pint; it has also been recommended in certain stages of scrofulous affections, but as regards its medicinal virtues, it is probably more valuable as a bath than used in any other way. It is from this source that a large portion of the Epsom and Glauber salts used in medicine, and the common salt used for domestic and manufacturing purposes, is derived.

## METHOD OF OBTAINING CREAM FROM MILK.

BY GEORGE CARTER, ESQ.

The process of divesting the milk of its component portion of cream, to an extent hitherto unattainable, has been effected by Mr. Carter, and is thus detailed by that gentleman in a paper presented to the Society of Arts.

A peculiar process of extracting cream from milk, by which a superior richness is produced in the cream, has long been known and practised in Devonshire ; this produce of the dairies of that county being well known to every one by the name of 'clotted,' or 'clouted cream.' As there is no peculiarity in the milk from which this fluid is extracted, it has been frequently a matter of surprise that the process has not been adopted in other parts of the kingdom.

The opportunities, says Mr. Carter, which I possess of making experiments connected with farming, induced me to direct my attention to the produce of the dairy, with a view to increasing the quantity and quality of cream and butter. Having, therefore, made some inquiry into the practice of the Devonshire dairymen, I found, that besides the improved quality of the cream, a larger quantity of butter was produced by this mode. I therefore adopted their system as the ground work of my experiment.

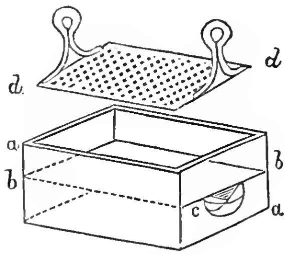
I found, however, that their process is attended with several disadvantages. The mode of applying artificial heat is rude, and the effect uncertain, being entirely dependent on the skill of the dairyman ; the result is also perpetually varied by the weather, and other accidental circumstances, over which he has no control.

My first object, therefore, was to construct my apparatus so that its operations should be (as nearly as possible) invariable, confining myself only to that part of the Devonshire process in which heat is applied to aid the separation of the cream from the milk. After a variety of experiments on the temperature applied, the period of its application, and the form and material for the vessels, I obtained the greatest results by adopting the following process: A four-sided vessel *a a* is formed of zinc plates twelve inches long, eight inches wide, and six inches deep, with a false bottom, *b b*, at one-half the depth.

The only communication with the lower compartment is by the lip *c*, through which it may be filled or emptied.

Having first placed at the bottom of the upper compartment a plate of perforated zinc *d d*, the area of which is equal to that of the false bottom, a gallon (or any given quantity) of milk is poured (immediately when drawn from the cow) into it, and must remain there at rest for twelve hours ; an equal quantity of boiling water must then be poured into the lower compartment through the lip *c*; it is then permitted to stand twelve hours more, (i. e. twenty-four hours altogether,) when the cream will be found

perfect, and of such consistence that the whole may be lifted off by the finger and thumb. It is, however, more effectually removed by gently raising the plate of perforated zinc from the bottom by the ringed handles, by which means the whole of the cream is lifted off in a sheet, without remixing any part of it with the milk below.




With this apparatus I have instituted a series of experiments; and, as a mean of twelve successive ones, I obtained the following results:

Four gallons of milk, treated as above, produced in twenty-four hours, four and a half pints of clotted cream, which, after churning only fifteen minutes, gave forty ounces of butter.

Four gallons of milk, treated in the common mode in earthenware pans, and standing forty-eight hours, produced four pints of cream, which, after churning ninety minutes, gave thirty-six ounces of butter.

The increase in the quantity of cream, therefore, is 12½ per cent., and of butter upwards of 11 per cent.

The advantage, however, is not limited to this increase of quantity, since it appears that in my process ten or fifteen minutes churning is sufficient to produce butter, whilst it requires ninety minutes to produce the same effect with the common cream. The results are also constant; no variety in flavor, color, or consistency, is observable, although my experiments have been made under circumstances which would have affected all these qualities in the common process.

I am not prepared to declare how much of the advantage of this operation depends on mechanical, and how much on chemical action. It has been long known that the application of artificial heat has facilitated the separation of cream from milk, probably by forming an ascending current in the fluid, as well as disengaging the suspended particles of cream by rendering the whole more liquid. But I have found that the material of which I make my vessels is a very important feature in the process; for the cream is formed in zinc vessels many hours earlier than in earthen ones. I hazard a conjecture, that this is owing to a galvanic effect, which is produced by the lactic and acetic acids (developed in the milk by heat and rest) acting slightly on the zinc plates of the vessel:

We have, therefore, two fluids acting on one metal, which is well known to be a galvanic arrangement of the second order. The acids, which would otherwise cause the coagulation of the milk, are thus taken up by the zinc; and the milk by remaining more perfectly fluid admits the easy ascent of the suspended cream. I have ascertained, on analysis, the presence of acetate and lactate of zinc in the skimmed milk, which would, therefore, seem to favor this hypothesis.

I ought to state, that my experiments have been made on land which is not most favorable for the production of butter, it being cold or gravelly; indeed, the whole of the Kentish land is unfit for producing cheese, a certain proof of its inferiority. As, however, my experiments have been comparative, and made with the produce of the same land, so it is reasonable to expect that proportionate advantages will be obtained in all cases, be the land richer or poorer.

I do not claim the merit of originality in this process farther than in the use of the zinc vessel, and the mode in which the heat is applied, by which the results are rendered certain and invariable; neither do I profess to have obtained the maximum of quantity which can be produced by this process. The operation, however, is so simple, and its efficiency so apparent, that it cannot be too generally known.

The experimental farmer will instantly perceive the advantages accruing from its adoption, and probably his attention to the subject may produce greater results. I shall feel richly rewarded, if, by exciting an interest on the subject, I can produce any, the slightest, improvement in the quality or mode of producing an article which may properly be deemed one of the necessaries of life.*—*Trans. Soc. Arts.*

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## PATENTS FOR MASSACHUSETTS.

*Granted in February, 1833.*

From the Journal of the Franklin Institute.

For a *Suction Hose for Fire Engines;* James Riley, Boston, Massachusetts, February 6.

After describing the construction of the common suction hose, which is made in pieces of about seven feet in length, and kept distended by copper ferules placed near together, an arrangement allowing of but little elasticity, and requiring much trouble in screwing the parts together, the patentee goes on to describe his improved suction hose, which is thus made:

* It appears from Mr. Carter's statement that milk which has been subjected to his process, is more or less impregnated with the soluble salts of zinc. The well known astringency of these salts, and their emetic quality when in a state of moderate concentration, induced the committee to inquire what use is made of the milk after separation of the cream. Mr. Carter replied that it is employed wholly in feeding pigs, and that the health and growth of these animals do not appear to be at all affected thereby

A leather hose is formed in the usual way, and over this is wound wire of a suitable size, running spirally from end to end. The wire is to be stitched to the leather, and the whole then covered with a varnish, formed by dissolving gum elastic in spirits of wine: a second tube of leather drawn over this completes the hose. We are told that thus constructed it will be elastic, may be made of any required length, and wound round some part of the engine when not in use.

The objections to the old plan will, in this supposed new mode, be succeeded by others, at least equally formidable. The coiled wire will soon break; in bending the hose, the wires on one side recede from, and on the opposite side approach each other, and will not resume their proper positions; when bent out of shape, the cylindrical form cannot be restored, and to such bending they are constantly liable. These and other objections caused such hose to be abandoned after a full trial seventeen or eighteen years ago, in the fire engine manufactory of Mr. Jacob Perkins, now Merrick & Agnew's, Philadelphia. How many other abortions this scheme may have undergone we know not; that which we have noticed, was, probably, not the first, and it is likely that the present will not be the last.

Nothwithstanding the utter absence of novelty in the general plan, there is something entirely original in the varnish made by dissolving gum elastic in alcohol; if the patentee has a good recipe for doing this, we hereby bespeak a right to it, either for love or money.

For a *Fireplace* for burning Anthracite Coal; William M. Russel, Boston, Massachusetts, February 8.

There are about this grate some things which are old and some which are new, but the patentee has not distinguished them from each other. The old parts consist in hollow jambs for heated air, air holes below the fire admitting air from without, and some other minor affairs. The construction of the grate, and the manner of hanging it, however, are, we believe novelties. The ends of the grate are solid plates of cast iron, placed parallel to each other. There are bars both at the front and back, made precisely alike, as either may become the front. There are two moveable bottoms, which are to be used alternately, in a way to be presently described. On the centre of each of the end plates, at the outside, there is a friction wheel, or roller, which also acts as a gudgeon, and on the jambs of the fireplace there are ledges upon which these rollers rest, and upon which they turn, allowing the grate to be drawn forward when required.

When the fire has been completely lighted, a register is opened which admits heated air to pass from the fire place into another room. If there is anything new in the mode of doing this, it is too obscurely described to make it known, and the drawing gives no representation of it, nor do we find any written references to the parts which are represented.

When the fire has gone out, or nearly so, fresh coal may be put into the grate, and charcoal upon it; the spare bottom is then to be placed and attached at top, the grate drawn forward and turned over, when what was the bottom is to be removed. The object of this is to prevent the necessity of raking out the coals to make a new fire. We think that one complaint is thus removed by introducing another which is equally, if not more, troublesome; the pulling out, and turning over, of the grate; the supplying a new bottom, and the getting rid of the old one, are each of them circumstances attended with trouble and inconvenience; all spare parts render such an affair objectionable in domestic economy, as they are not disposed of so easily as spare dollars, or kept in order with the certainty of fixtures.

For the *Application of Lithography to the Printing of Books, Pamphlets, &c.;* Robert Charles Manners, Boston, Massachusetts, February 15.

This invention the patentee denominates TYPOLITHOGRAPHY. The mode of proceeding is to have a copy of the work to be transferred to stone, printed with the kind of ink adapted to that purpose, or with any kind of ink which will answer the intention. The patentee says that he does not claim to be the inventor of copying generally by lithography, 'but to be the inventor of the application of lithography to the purpose of reprinting such printed works as aforesaid.' This 'invention of the application' appears to us rather equivocal, as there is no pretence made to novelty, excepting in applying the transferring to the printing of books. Now every one having any acquaintance with lithography, knows how to make such transfers, both from letter press, and copperplate printing; it has often been spoken of in publications on the subject, and some few months since it was announced in the journals of the day, that a mode of transferring the common ink, even from old books, had been discovered in Europe, by means of which copies of them might be lithographically multiplied with great facility.

For an improved *Stereotype Block;* Enoch Hale, Boston, Massachusetts, February 15.

This resembles so closely the first stereotype block which we recollect to have seen in use, that we really cannot tell the difference between them; they seeming to us to be much like some twins whom we have known, bearing so strong a likeness to each other, that it was necessary to see them together in order to distinguish them from each other. There are the usual two fixed clasps on one side of the block, and two moveable ones on the other; two screws, the heads of which work against the plates of the fixed clasps, pass through the block and into tapped holes in the moveable clasps. The heads of the screws may be formed

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into pinions, and turned by a suitable instrument; or they may be turned in any other convenient mode. 'The invention consists only in the form, and manner of adjusting, the nuts.'

For a *Composition for Drying Oil Paints;* Nathan Hemenway, West Springfield, Hampden county, Massachusetts, February 22.

The composition is formed by taking umber, sugar of lead, white vitriol, and litharge, of each one pound, and adding thereto two pounds of white lead, and half a pound of shellac, red lead, and blue vitriol.

The *acids* of these materials are to be extracted by heat, for which a furnace may be used, having a bottom and sides of brick, and a top of sheet iron. The oils are to be used without boiling.

The foregoing contains all the information given; this, however, is not much to be regretted, as the whole thing is altogether ridiculous. The patentee has certainly made a fine assemblage of dryers, with the exception of the shellac, which in his composition will be something like 'chips in porridge.' About the *acids* that are to be expelled there is some mystery, which the brick furnace, with its iron cover, does not enable us to explain.

For a *Machine for Making Cooper's Rivets;* Timothy Allen, Plymouth, Plymouth county, Massachusetts, February 28.

This is a machine for cutting off the wires, or rods, into proper lengths for a rivet, and impressing the heads upon them by suitable dies. The operation of the machine is not rendered clear by the description and drawing, but it manifestly resembles, in several particulars, other machines for heading rivets and screws; there possibly may be some novelties of arrangement sufficient to entitle this to the character of a new machine, but, if so, they are not made plain. The claims are to 'the conveyance by the punch, and holding the rod whilst headed by the punch. The solid cast iron die is applied to making rivets by one operation.'

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From the New Edinburgh Philosophical Journal.

## COMPETITIONS AMONG MECHANICS.

All of the useful arts admit of two distinct kinds of improvement. The one is by new inventions, the other by rendering workmen more expert.

The encouragement of invention has long been a favorite object with the public, and every one also is sensible of the importance of having operative mechanics properly instructed; yet hardly anything has ever been done towards attaining this last end, however desirable. Indeed, if we except the case of ploughmen, scarcely one class of the members who are employed in providing us with the necessaries of life, has ever had the stimulus of a prize for superior excellence held out to them, though there is not one among them to whom it might not be applied with perfect ease and with incalculable effect.

However varied and complicated a man's employment may be, a very few simple operations will suffice to show his merits. Thus, from the formation of a mortise and tenon, from the construction of a pannelled door, from the fitting of a drawer, the jointing of a leaf of a table, and one or two other such works, a perfect idea may be formed of the qualifications of all the various denominations of square-men, in every stage of their progress. Each of these works might accordingly be assigned to a separate class of competitors, as the test of their advancement; and in every other trade a similar selection might be made, adapted to the various degrees of proficiency of its members. By these means some object of ambition might be placed within the reach of the youngest apprentice, while the most expert workman would not find himself without rivals; and to preserve his pre-eminence, would be compelled to continue his exertions.

The details of such a system must of course be left to practical men; but there are one or two general principles which appear to apply universally, and which, indeed, seem quite necessary to the success of any attempt of the kind. 1. No class should be so large as not to afford a fair chance of success to every individual comprised in it; but that superior merit may obtain a corresponding distinction, the successful competitors in the first class should be brought again in competition with one another for an additional prize, just as in a coursing match. 2. That every one may know with whom he is to contend, the name of each competitor should be entered in a public list, a considerable time before the day of trial. 3. The work by which the merit of each class is to be ascertained, should, as far as possible, be executed in the same place, and at the same time, both to insure that no one shall produce anything but what he has himself executed, and also for the purpose of comparing the different modes of doing the same thing, practised by different workmen. 4. That competitors may have complete assurance of perfect impartiality, they ought, in every case, to have the choice of their own judges. 5. It may be mentioned, in the last place, that books appear by far the best prizes that can be given, both on account of the valuable information which may be thus communicated, and also because a suitable inscription can be put upon them at no expense.

These principles of competition have already been tried with great success by the Glenkens Society, an institution which was formed about two years ago in a retired district of the Stewartry of Kirkenbright, for a similar purpose with that now under consideration; and there can be no doubt that competitions thus conducted, would be still more beneficial under the influence of the condensed population of a large town.

It has long been a general complaint among masters, that they find it next to impossible to fix the attention of their apprentices: that even their journeymen can hardly be prevailed upon to take

an interest in their work beyond what is necessary to provide themselves with bread, and that the idle hours of both are grossly misspent. Indeed, so long as their utmost dexterity and skill can do so little towards raising them into public notice, we can hardly wonder that their work should hang so heavily on their hands; and that their relaxations should be of a kind of which we cannot approve. But were a ladder afforded to a working mechanic by which he might raise himself step by step from his obscurity to such a station as his talents and acquirements enable him to fill with credit to himself and benefit to the public; and were it made plain to him that whatever step he may at present occupy on this ladder, no great exertion would be required to gain one step higher, there cannot be a doubt that the emulation which has by similar means been excited among ploughmen, would be excited in him also, and in a much greater degree. The ordinary occupations of a workshop would become interesting to him as preparations to his public exhibitions; and the time during which he is not thus engaged, would be employed by him in gaining some acquaintance with such branches of science as may be connected with his trade. This unquestionably would be the effect of these competitions on all the ablest men among these classes; and as it is from them that the whole take their tone, their example would be speedily followed. The community at large would become industrious and economical, and men who now sink through all the gradations of idleness and want, till they end in crime, would become active and useful members of society.

This would necessarily produce no inconsiderable diminution in the number of paupers, while it would at the same time tend to lessen the expense of all the necessaries of life. Every hand being improved to the utmost, and employed in the best possible way, would be rendered proportionably more productive, and as the most important inventions have almost all been made by working mechanics, a very rapid addition to them might be confidently anticipated, from the prodigious force of the talent thus brought into operation, which is at present altogether dormant.

To these considerations it must be added, that the proposed competitions would do much towards establishing the connection between the higher and lower classes, which, of late years, has been almost entirely done away, very much to the injury of both. Indeed, however anxious a rich man may now be to make himself useful to his poorer neighbors, he has it not in his power. He comes seldom into contact with any of them, but such as have already reduced themselves to beggary by idleness and dissipation, and, finding that anything he may give them is worse than thrown away, he either abstains from charity altogether, or commits his contributions to some of the benevolent societies with which his country abounds. By them he is sure that his donations will be

judiciously administered; but, when thus made they will do nothing towards securing him a place in the affections of the persons relieved, who, being unacquainted with their benefactor, cannot, of course, make to him any return of gratitude. But were the stamp of merit fixed on the really deserving by these competitions, a class of persons would be offered to the notice of the higher ranks, who would be every way deserving of their countenance. To them it would be given willingly and liberally. It would not fail to produce corresponding feelings of attachment and respect, and the various ranks would thus gradually become bound together by all those sympathies which enhance the joys, and sooth the sorrows of life.

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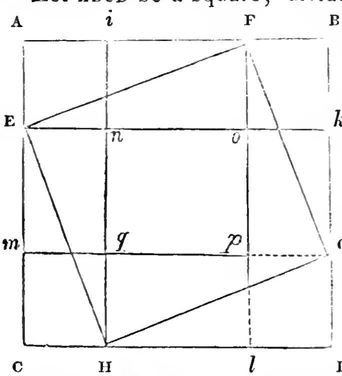
For the Young Mechanic.

## NEW DEMONSTRATION OF THE FORTY-SEVENTH PROPOSITION OF EUCLID.

NEW demonstration of the theorem, 'That the square of the hypothenuse is equal to the sum of the squares of the two legs of a right angled triangle.'

The following method of showing the above fact, seems to me to show the truth more clearly to the eye, on account of the peculiar construction of the figure, than the demonstration usually given in books of Geometry.

Let ABCD be a square; divide the line AB into any two parts at pleasure, as AF FB. Then set off BG, DH and EC = AF. The remaining parts FB, GD, CH and AE will of course be equal. Draw EF, FG, GH, and EH, thus completing the triangles, AFE, FBG, GHD, and ECH, which will be equal and similar; for in AFE, AF is equal to BG, in FBG, and AE is equal to FB, by construction, and the included angle in each triangle is a right angle, being one of the angles of the square, ABCD.




In the same manner as we have shown AEF and FBG to be equal, can we show of any of the four above mentioned. The sides, then, EF, FG, HG and EH, being the hypothenuses of the above triangles, are equal. We then say that the angles EFG, FGH, &c., of the quadrilateral, EFGH are right angles, for, in the triangles AEF and FBG, being similar triangles, AEF opposite AF is

equal to BFG opposite BG. AFE and BGF are for a similar reason equal. Then since AEF and AFE = one right angle, AFE and BFG = one right angle, and since AFE + BFG + EFG = two right angles, it follows that EFG is a right angle.

In the same way can we prove that FGH and GHE are right angles — EFGH, is therefore a square.

Now draw E*k* and *m*G parallel to AB, and *i*H and F*l* parallel to AC, which will divide the square ABCD into the rectangles AEF*o*, FBG*p*, &c., and the squares AE*in*, FOB*k*, *nopq*, &c. The rectangles AEF*o*, F*p*GB, &c., are double the triangles AEF, FBG, &c.

Now AF*mp* is the square of AF, one leg of the triangle AEF, and AE*in*, (equal to *mq*CH, on account of the parallel lines and equal sides of the triangles at each angle of the square ABCD,) is the square of the other leg AE. These two squares contain the rectangles E*n*CH and AEF*o*, plus the square *nopq*.

EFGH is the square of the hypothenuse EF, and this contains the four triangles, EF*o*, E*n*H, GH*q*, and F*p*G, (which are equal to two of the rectangles,) and the square *nopq*. Therefore the squares of the legs are together equal to the square of the hypothenuse, and the triangle not being by construction limited to any proportion of sides, the demonstration is general and complete. B. B.

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From the London Mechanics' Magazine.

## MR. HANCOCK'S STEAM OMNIBUS.

SIR,—More than six years have elapsed since I began my experiments on steam locomotion; and I have followed it with an ardor that did not admit of any diversion from the grand object which I kept steadily in view. During the past week I have exhibited daily on the Paddington road a steam omnibus, the result of my experience; and having hitherto carefully steered clear both of extravagant anticipations and exaggerated statements, I should be very sorry if any such should now find their way into the public prints. In order to prevent this, as far as I am able, I beg to hand you, for insertion in your wide-spreading miscellany, the following results of the first six days:

April 22.—Started from cottage lane, City road, to Paddington, and from Paddington to London Wall, and back to Cottage lane —9½ to 10 miles—1 hour, 8 minutes. Delays 18 minutes; travelling 50 minutes.

April 23.—From Cottage lane to Paddington and back to Cottage lane—8½ miles—1 hour, 11 minutes. Delays 9 minutes; travelling 62 minutes.

April 24.—Same ground—1 hour 4 minutes. Delays 11 minutes; travelling 53 minutes.

April 25.—Same ground and back as far as St. James' Chapel; piston broke.

April 26.—Same ground and back to Cottage lane—49 minutes. Delays 5 minutes ; travelling 44 minutes.

April 27. Same ground—50 minutes. Delays $5\frac{1}{2}$ minutes ; travelling $44\frac{1}{2}$ minutes.

Average quantity of coke, one sack to each trip.

It is not intended to run this carriage more than about a week longer ; partly because it was only intended as a demonstration of its efficiency, and partly because my own occupation will not admit of my personal attention to the steering, which I have hitherto performed myself, having no other person at present to whose guidance I could with propriety entrust it. During the time that it will require to build two more carriages for the Paddington Company, I shall have one or two others of my own running, which will afford me an opportunity for training steersmen, &c., for this road, which, of all others, I am acquainted with, requires the greatest steadiness and attention.

I am, sir, your obedient servant,

*Stratford, May* 1, 1833. W. HANCOCK.

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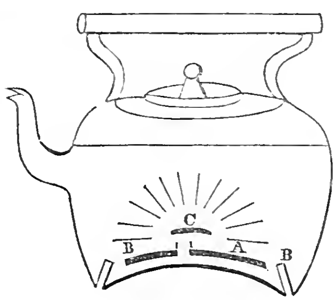
From the London Mechanics' Magazine.

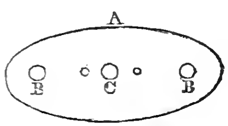
## STEAM TEA-KETTLE.

'SIR,—Having found that in all cases steam forcibly introduced into the lower parts of a vessel of water, would heat the water in it quicker than a strong fire, applied externally to the vessel itself, I beg to send you a description of a boiler or kettle of simple construction, which boils in about half the time that otherwise would be required.

I am, Sir, Yours, very obediently,

*Wellesbourne, March* 8, 1830. W. H. B.'




'A, second concave metal bottom to the boiler. BB, apertures for the admission of the cold water. C, vent for the heated steam.'

# Miscellany.

*Sheet Iron Roofs.*—Sheet iron coverings are now universally made use of on all new buildings in Petersburg, Moscow, &c. In the case of a fire no harm can come to a house from sparks falling on a roof of this description. The sheets of this iron covering measure two feet four inches wide by four feet eight inches long, and weigh twelve and a half pounds avoirdupois per sheet, or one pound five ounces each superficial square foot. When the sheets are on the roof they measure only two feet wide by four feet in length; this is owing to the overlapping. They are first painted on both sides once, and when fixed on the roof a second coat is given. The common color is red; but green paint, it is said, will stand twice the time. Small bits or ears are introduced into the laps for nailing the plates on the two inch square lath on which they are secured.

It takes 12½ sheets to cover 100 feet, the weight of which is only 150 lbs.: the cost only 35s, about 3d per foot.—***Repertory of Patent Inventions.***

*A new method of preserving Iron work from rust.*—This consists in plunging the pieces to be preserved in a mixture of one part concentrated solution of impure soda, (soda of commerce) and three parts of water. Pieces of iron left for three months in this liquid had lost neither weight nor polish, whilst similar pieces, immersed for five days in the simple water, were covered with rust.—*Reoueil Industriel.*

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## QUESTION.

*Sonorous Stones.*—There is a kind of stone, by no means uncommon, which has the property of ringing on being struck. It is of a granular even texture, homogeneous color, generally purplish and considerably hard; more than middling composed with other stones. I should like to know if any mineralogist can recognise in the above description, any specimen which either his cabinet or manuals contain or describe.

B. B.

# THE

# YOUNG MECHANIC.

## NOVEMBER, 1833.

### CHEMISTRY.

#### DEUTOXIDE OF HYDROGEN.

OXYGENIZED WATER.—This interesting compound was discovered by M. Thenard, in the year 1818.

It contains twice the quantity of oxygen that common water contains.

| | |
|---|---|
| 1. Proportion of hydrogen, | 1. |
| 2. Proportion of oxygen, | 16, |
| Its representation number is | 17. |

Its specific gravity is 1·453. It is a clear, colorless liquid without odor, and possessing a metallic taste which is difficult to describe, but approaches that of tartar emetic. It remains liquid at all temperatures to which it has hitherto been exposed. Light produces no effect upon it, and but little change takes place when it is exposed to the direct rays of the sun, if it be not thereby heated to the degree at which decomposition takes place. Applied to the skin, in a diluted state, it attacks it, producing a prickly sensation, and rendering it white; when concentrated, the skin is rapidly destroyed by it.

It is decomposed at a temperature of 59° Fah. being converted into water and oxygen. At a temperature of 212° Fah. so rapidly is the oxygen extricated, that an explosion is produced. It is decomposed also by animal substances. Dropped on the dry protoxides of many of the metals, or of some of the metals in a minutely divided state, it produces violent detonations. All the

metals, except iron, tin, antimony and tellurium, have a tendency to decompose it; those which have a strong affinity for oxygen combine with it, while others retain their metallic state. In the 17th vol. of the American Journal, p. 34. Dr. Faust has suggested that this curious phenomena may be accounted for upon galvanic principles: thus, 'When any metal is placed in the deutoxide of hydrogen, a galvanic effect is produced. The hydrogen having less affinity for the *excess* of oxygen, than the metal has, the liquid becomes negative, thus acting the part of the copper plate of a battery, while the metal becomes positive, supplying the place of a zinc plate. The liquid is thus resolved into water and oxygen. If the metal be very oxidable it retains the oxygen, which is evolved, if gold, platina, &c. be used.'

Acids have the property of rendering this compound more permanent; thus, if it be heated until decomposition commence, or a little finely divided gold be put into it, the brisk effervescence which ensues from the decomposition, will be seen immediately to cease upon adding a drop of sulphuric acid. The only acids which do not possess this property, are those which possess but little acidity, or are decomposed by deutoxide of hydrogen.

The method adopted for its analysis is to boil it, with an equal quantity of water, in a retort connected with a graduated receiver filled with mercury. It is thus resolved into water and oxygen, and the oxygen is collected in the receiver.

Deutoxide of hydrogen has been applied by M. Thenard, to some old and valuable paintings, for the purpose of removing some black stains which they had contracted, with perfect success. It is well known that the whites formed of carbonate of lead, when not perfectly protected by varnish, are apt to turn black; this is occasioned by sulphuret of lead being formed, and oxygenized water has the property of converting the sulphuret into a white sulphate. M. Thenard states that the other colors were not in the slightest degree affected in his experiment, which would not have been the case had he used other agents which were suggested.

To prepare deutoxide of hydrogen, many precautions are necessary in order to ensure perfect success. We shall, therefore, minutely describe the process which has been given by M. Thenard.

1. A general outline of the process is as follows: Deutoxide of barium, is added to water containing hydrochloric acid; when dissolved, sulphuric acid is then added, which precipitates the baryta in the form of insoluble sulphate,—the water now contains hydrochloric acid and a portion of oxygen—more deutoxide of barium is added—again precipitated by sulphuric acid, and this is repeated until the liquid contains from 25 to 30 times its volume of oxygen gas. The hydrochloric acid is now removed, by the addition of sulphate of silver, and we have sulphuric acid remaining in its place, which is removed by solid baryta. We have now

deutoxide of hydrogen diluted with water. To render it pure, the water is evaporated under the exhausted receiver of an air-pump till it acquires the specific gravity of 1·452.

We shall now give the process as described by M. Thenard, and first the method of preparing the deutoxide of barium.*

1. Nitrate of baryta should first be obtained perfectly pure, and above all, free from iron and manganese. The most certain means of procuring it, is to dissolve the nitrate in water, to add to the solution a small excess of baryta water, to filter and crystallize.

2. Decompose the nitrate by heat, in a perfectly white porcelain retort. It will contain only silex and alumina in any considerable quantity, if the retort be as described ; the iron and manganese will be only in very minute quantity.

3. Divide the baryta into lumps as large as the end of the thumb, and place them in a luted tube of glass, then heat the tube to redness and pass through it a current of dry oxygen gas. The gas will be completely absorbed, however rapid the current, and consequently when it passes out, at the other end of the tube, we may conclude the operation, the deutoxide of barium being finished. When nearly cold, it should be transferred into well stopped bottles.†

1. To prepare now the deutoxide of hydrogen, place in a glass vessel surrounded with ice, a certain quantity of water (4 or 5 pints for example) and add to it as much hydrochlorate acid as will dissolve 232 grains of baryta. Then 185 grains of the deutoxide of barium, are to be slightly moistened and rubbed in a glass mortar ; when reduced to a fine paste it is to be placed in successive portions in the fluid, and will soon dissolve. Pure and concentrated sulphuric acid is then to be added, the fluid being stirred at the same time, until the sulphate of baryta is deposited in flocouli, which indicates that there is a slight excess. It is important to add enough sulphuric acid to precipitate all the baryta, but not too much ; when the proportions are properly adjusted, filtration is effected with great facility. When the filtration is completed, a small quantity of water is to be passed through the filter and added to the fluid. After this, that none may be lost, it may be washed with more water, and the water reserved for washing future filters.

This operation being finished, more deutoxide of barium is to be dissolved in the fluid; the baryta precipitated by sulphuric acid and so on, proceeding as before.

* We have made some variaitons from the words of the author, in order to condense or render more plain his meaning, but none which affect the sense, or neglected anything necessary to the success of the process.

† If the heated tube be withdrawn from the fire at a proper time, the barium will be obtained in the state of deutoxide, without the use of oxygen gas.—TORREY.

These operations are to be repeated until we have used about 3 ounces of deutoxide of barium; when the fluid will contain from 25 to 30 times its volume of oxygen.

2. When the fluid is oxygenated up to the required point, the next step is to remove the silica, alumina, oxides of iron, and manganese. For this purpose the fluid is to be saturated with deutoxide of barium, while still remaining in ice. Abundant flocculi of silica and alumina, soon separate, which are generally colored by the oxides of iron, and manganese. The whole should then be thrown quickly on a cloth, and closely compressed.

As the fluid may still retain a small quantity of the substances mentioned, it is again to be surrounded by ice, and *baryta* water added to it, drop by drop, the whole being stirred. If, when the baryta is in such excess as to be slightly sensible, there is no precipitate, it proves that all the oxides of iron and manganese have been separated.

3. If not completely separated by the preceding operation, they will be by this.

Immediately on the separation of them, the fluid must be placed on two or three filters, in order to hasten its separation from the oxides, which otherwise would soon decompose it.

The fluid which now contains only hydrochloric acid, water and oxygen, while surrounded by ice as before, is to have dropped into it sulphate of silver, until all the hydrochlorate acid is separated. When this is the case, the fluid becomes clear; until then it remains turbid. That there may be no excess either of hydrochloric acid, or sulphate of silver, small portions of the fluid may be successively tested by nitrate of silver and hydrochlorate acid. The liquid is to be filtered when this point is attained.

4. We have now a fluid composed of water, oxygen, and sulphuric acid, and it remains to separate this latter substance. For this purpose the fluid is transferred to a glass mortar, surrounded by ice, and slacked baryta, finely powdered, added by small portions at a time, and rubbed with it. When the fluid scarcely reddens litmus paper, it is to be filtered, and the filter compressed in a cloth; the saturation is then to be finished by baryta water.

5. The fluid may now be considered as pure oxygenated water, diluted with common water. In order to concentrate it, it is to be placed in a glass vessel over a dish of concentrated sulphuric acid, and the whole placed under the receiver of an air pump and a vacuum formed. By this means, the water is to be evaporated until the fluid acquires the specific gravity of 1·453.

From the Louisville Herald.

## MECHANICS.

It is unfortunately the fact, that too many parents look upon mechanical employment as degrading, and prefer that their sons should be quacks and pettifoggers, rather than useful and respectable mechanics; hence it is, that our country is overrun with men calling themselves lawyers and doctors, who are at the very tail of their respective professions, but who, if their talents, or the bent of their genius had been consulted, would have made excellent mechanics, and have risen to wealth, and an influential and respectable place in society. But an absurd prejudice, or dislike to the name of mechanic, has doomed them to a life of comparative poverty and insignificance. Such men do not reflect, that if they possess talent, combined with industry and a disposition to seek information, they may rise to eminence, notwithstanding they may wear the apron of a mechanic, instead of the gown of the lawyer. Who were Franklin, Rittenhouse, Roger Sherman, and a host of others? They were mechanics—practical mechanics; but they became philosophers and statesmen, and established a fame which shall endure as long as time shall last. On this subject we copy the following sensible remarks from the Beaver Republican:

Mechanics.—'There is a strange dislike to the name of mechanic in this country, as well as elsewhere; it would almost seem a disgrace to be an industrious or useful man. Each parent thinks his child superior in intellectual capacity, and capable of filling any station, whatever his ability to qualify him therefor. Hence we everywhere meet with professional men, who would doubtless make most excellent mechanics, but, unfit for a profession, they remain all their lives in obscurity and poverty. Why is this? Have not the world yet learned to judge men by their actions, and not by the business they pursue? Look through the pages of history—whose names are brightest?—who have been the benefactors of mankind?—Why do we so often find men of sound judgment in all things else, yielding to the dictates of pride and prejudice, and preferring that their children should be brought up in idleness, rather than give them such an occupation as would enable them to become useful to themselves and others?'

## PATENTS FOR MASSACHUSETTS.

*Granted in March, 1833.*

From the Journal of the Franklin Institute.

For apparatus for *Manufacturing Ship Thimbles;* Barnabus Thatcher, Yarmouth, Barnstable county, Massachusetts, March 2.

The first part of the apparatus is a pair of tongs, made like smiths' tongs, so formed that when shut, the jaws will form a perfect circle, equal in diameter to the outer diameter of the thimble. A concave swedge, of the proper size and form, is fitted to the hole in an anvil. The ring, heated, and held in the tongs, is then to be struck by a concave tool, properly formed, by which means the thimble will be completed. It is said that a screw, or other press, with suitable dies, may be substituted for the tools above described.

There is no particular claim made, the process being considered as altogether new in its application. We do not know that this is not the case, although it is not improbable that a mode of operating so common in the making of thousands of articles, such as the swedge, or bed, and punch, has been adopted, if not here, in some of the European navy yards, in the manufacture of ship thimbles. If this has not been the case, it is well for the patentee, as we are informed that the thimbles made by his process are not only more rapidly but much more perfectly formed than by that usually followed.

For *Machinery for Making and Pegging Shoes;* Samuel Preston, Danvers, Essex county, Massachusetts, March 8.

This is an ingeniously contrived, and, we think, a well arranged apparatus for making shoes, fastened by wooden or metallic pegs. The specification is of considerable length, and although it describes the machine clearly, it would require an engraved plate for its illustration. The claims made are the following :

'What I claim as my own invention in the within described apparatus, is that arrangement thereof by means of the intermitters, or a single intermitter, or other analogous contrivance, with the guides, and other appendages, by means of which the shoe carriage is caused to advance with the shoe thereon, whilst the pistons carrying the awls and drivers, receive, by means of guides, or formers, a lateral motion, following the shape of the sole of the shoe : whether these motions be effected precisely in the way described, or in any other, producing a similar effect.

'I claim also the arrangement of the parts of the machinery by which the pegs, or nails are driven by one set of pistons, in the holes made by the awls in the pistons by their previous descent.

'I claim, likewise, the splitting the peg from the end of a slip of pegwood, or the cutting of pegs or nails, from a strip of metal, and the instantaneous driving thereof into the proper place.

'I further claim the application of the forcing apparatus, the piston, and also the forcing wheel, and the method, subsequently described, of smoothing and polishing by means of revolving wheels.'

For a *Safety chain to be used in careening Ships;* James Fales and Thomas D. Brown. New Bedford, Bristol county Massachusetts, March 9.

The safety chain is intended to brace the mast, by connecting one end of it to the top of the mast, and the other end to chains connected with the wales. The chain leading from the top of the mast, is to be connected to those attached to the wales by the intermedium of a screw, which turns in nuts attached to the chains, and by which they may be rendered tort. These chains are to be fixed on the side opposite to that on which the vessel is to be hauled down.

The claim is to the connecting such chains in the manner, and for the purposes described.

For an improvement in the *Broad Power Loom;* John Leland, Millbury, Worcester county, Massachusetts, March 9.

After describing the construction of the loom, it is observed that in all the power looms now in use, the shuttle is driven by means of stud collars inserted into the cams by which the harness is operated, and that the usual number of beats, or jerks, for a loom weaving cloths, of from ten to twelve quarters wide, is forty per minute; and as the cams in a loom for plain cloth revolve but half the number of times the lathe beats, and but a quarter of the number for kersey, the motion given to the stud rollers is very slow, which requires the inclined planes of the picker shoe, where the stud rollers are received, to be very steep or abrupt, in order to give sufficient force to the shuttle, and the motion thus given to the shuttle is a very hard and unnatural one, producing a trembling and agitation throughout the whole loom. To obviate this difficulty, and construct a loom in which the shuttle motion shall remain the same, not only for plain cloth but for kersey, or any kind of double work, is the object of this improvement, which consists, first, in placing the lathe shaft in such a position in the loom as to admit of its operating not only the vibrating cams, but of its driving the shuttle. Secondly, in ranging the vibrating cams to the pivots on which the lathe standards rest, and hanging them to the same. Thirdly, in motioning the shuttle with but one stud roller, and one picker treadle.

For *Cementing Cloth;* Reuben Brackett, Boston, Massachusetts, March 14.

The cementing is to be effected by means of a solution of India rubber, so as to unite two edges without sewing, and in this the whole claim consists; such solutions, therefore, are to be used as are already known.

The cementing of cloth, by means of a solution of caoutchouc is not a novel process; water proof cloth having been prepared in England and France by cementing together two thicknesses, for the purpose of making cloaks and other articles. Cloths of two colors have sometimes been so united, when it was desired to have the lining of one, and the outside of another color. As regards the uniting of seams in this way, it may undoubtedly be effected so as to render them perfectly firm, and we are not aware that the doing so has ever been proposed previously to the obtaining of the present patent. Whether the appearance of the seams will be such as to please the eye, and whether the cementing can be effected without keeping the cloth under pressure for a period which may be inconvenient, are questions which the patentee has probably asked and answered.

For an improvement in the *Roller Gin for Ginning Cotton;* William Whittemore, senr., and William Whittemore, jr., West Cambridge, Middlesex county, Massachusetts, March 21.

A very minute description of the roller gin is given in the specification, which refers throughout to perspective and sectional drawings. The parts which are claimed as new are plainly designated, and consist of 'the guard, felts, and clearer.' The *guard* is a piece of cast steel, which works upon two arms in the frame of the ginning rollers, its lower edge, which is to be about one-sixteenth of an inch thick, smooth, and rounded, drops nearly into contact with the felt or the lower roller. The object of this is effectually to prevent the seeds of cotton from being drawn in with the staple between the rollers. The *felts* are endless aprons of leather, which are substituted for cloth, as possessing many properties which render it superior to the latter article. Of these *felts* there are three, with their appropriate rollers; one of these is the feeding apron; the other two receive the cotton and carry it along from the ginning rollers, round which they pass. The upper apron inclines upward, and the lower apron downward; a part of the cotton adheres to the upper felt, but the larger portion of it to the lower one. The *clearer* is a frame worked up and down by a double crank shaft, having two combs attached to it, like those of the common carding machine, and serving, in a similar way, to remove the ginned cotton from the felts.

For a *Cooking Apparatus;* Thomas K. Anderson, Boston, Massachusetts, March 22.

The form of the part of this apparatus in which the fire is contained is that of the common cylindrical stove, with its grate and ash pit. This cylinder is surrounded by a second, extending from the bottom of the former to about two-thirds of its height. This is made tight, to contain water in which to boil meat or vegetables. The top of the interior cylinder is surmounted by an

oven, which is surrounded by a casing, for the conveyance of heated air and smoke, which must have an outlet at top. In this oven, baking, frying stewing, &c. are to be performed.

'The inventor claims as his invention the combination of apparatus above described, and its arrangement for the purposes set forth.'

We do not perceive upon the face of this arrangement anything which recommends it to special favor. The cylindrical vessel in which meat and vegetables are to be boiled, is attached firmly to the stove, and the fluid must be drawn from it by means of cocks. It cannot be removed to be rinsed and wiped by the cook, which, among those who are cleanly, is a point of some importance. The oven, or case, at top, is less *comeatable* than it ought to be, and in general it appears likely to give out too much of the odor of the good things before they are ready for the table; a defect very common in cooking stoves.

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From the Mechanics' Assistant.

## CUTTING STEEL WITH SOFT IRON.

This was done and an account of it published many years ago in England, but the following extract from Silliman's Journal is the most simple application we have seen, and this may be tried by thousands without incurring expense: we give it in preference to others. The fact is, that *soft* iron will *cut hard* steel, for the same reason that soft water makes an indention in hard stone, by a continual dropping, and had his reverence been a classical scholar, he would have recognized an old latin example, precisely upon this point. The soft iron cuts the hard steel because the iron constantly works on the same line on the steel, which it makes *hot* and *soft;* besides, the soft iron *impringes* on the steel, in proportion to its *momentum*, that is, its rapidity multiplied into its weight: the edge of the iron, through its circumference, comes in contact with a single point, or rather small line on the steel, the iron therefore keeps comparatively cool and consequently hard, and wears on the whole circumference, while the object cut, wears only in one part. It is evident that everything must depend upon the accuracy of the instrument, so that the same line may be struck at each revolution of the iron. The iron not touching the steel is utter nonsense. We have seen the bottom of a black wine bottle cut off, by a cord and the application of cold water, simply by coiling the cord over the bottle backwards and forwards, and then suddenly plunging the bottle in cold water, yet the string remained cool, but the bottle was hot in the particular part round which the string went; should this be attempted, some contrivance should be adopted to keep the string in the same situation, during the operation, or the experiment will fail.

Extract of a letter to the Editor of Silliman's Journal, from the Rev. H. Dagget.

'I take the liberty to communicate to you a fact which has lately come to my knowledge, and which I judge may be of considerable use to the mechanics, and perhaps in philosophy. It may not, however, be new to you.

Mr. Barnes (a cabinet maker of this place) had occasion to repair a cross-cut saw, to be used by two persons, of a very hard plate, which would require considerable labor in the usual way of filing. He recollected having heard that the Shakers sometimes made use of what he called a buzz, to cut iron. He therefore made a circular plate of sheet iron, (a piece of stove pipe,) fixed an axis to it, and put it in his lathe, which gave it a very powerful rotary motion. While in motion he applied to it a common file, to make it perfectly round and smooth, but the file was cut in two by it, while it received itself no impression. He then applied a piece of rock crystal, which had the desired effect. He then brought under it the saw plate, which in a few minutes was neatly and completely cut through longitudinally. When he stopped the buzz, he found it had received no wear from the operation, and that he could immediately apply his fingers to it, without perceiving much sensible heat. During the operation, there appeared a band of intense fire round the buzz, continually emitting sparks with great violence. He afterwards marked the saw for teeth, and in a short time cut them out by the same means.'

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From the New York Mechanics' Magazine.

## LAMBERT'S CANE RIFLE.

This drawing represents the most compact and convenient rifle that we have ever seen, and we think has ever been invented.

The top figure represents it entirely shut, having the appearance of a substantial walking cane.

In the figure underneath it is represented ready for firing, in which position it can be placed almost instantaneously. The head is drawn out sufficiently far for the socket or ferule at the muzzle (which is attached by a strap of metal in the side of the socket, with a hinge at the extremity) to fall off by its own weight, (see drawing.) The cock is a bent lever of steel, made to turn and move on a hollow pivot pin, containing a chamber for powder, which is continued through the screw by which it is inserted, and opens into the barrel. The trigger lays in the plate which covers

the lower side of the cock. By bending down the head of the cane (see drawing) the lower edge of the slide plate* catches a small dog of steel, with a notch or tooth in it, which rests on a spring let into the foot of the cock, and thus elevates the long arm of it. The head thus bent serves for a breech, by which the gun is conveniently held and aimed, by looking through a small slit in the cock over the sight in the ferule.

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## ANTIQUITY OF MECHANICAL SCIENCE.

We read in Genesis, that ships were as old, even on the Mediterranean, as the days of Jacob. We likewise read that the Philistines brought thirty thousand chariots into the field against Saul; so that chariots were in use 1070 years before Christ. And about the same time architecture was brought into Europe. And 1030 years before Christ, Ammon built long and tall ships, with sails, on the Red Sea and Mediterranean. And, about ninety years after, the ship Argo was built, which was the first Greek vessel that ventured to pass through the sea, by help of sails, without sight of land, being guided only by the stars. Dædalus, also, who lived 980 years before Christ, made sails for ships, and invented several sorts of tools for carpenters and joiners to work with. He also made several moving statues, which could walk or run of themselves. And, about 800 years before Christ, we find in 2d Chron. xv. that Uzziah made in Jerusalem, engines, invented by cunning men, to be on the towers and upon the bulwarks, to shoot arrows and great stones withal. Corn mills were early invented; for we read in Deuteronomy, that it was not lawful for any man to take the nether or the upper millstone to pledge; yet water was not applied to mills before the year of Christ 600, nor windmills used before the year 1200. Likewise, 580 years before Christ, we read in Jeremiah xviii. of the potters, wheel. Architas was the first that applied mathematics to mechanics, but left no mechanical writings behind him; he made a wooden pigeon that could fly about. Archimedes, who lived about 200 years before Christ, was a most subtle geometer and mechanic. He made engines that drew up the ships of Marcellus at the siege of Syracuse; and others that would cast a stone of a prodigious weight to a great distance, or else several lesser stones, as also darts and arrows; but there have been many fabulous reports concerning these engines. He also made a sphere which showed the motion of the sun, moon and planets. And Polidonius afterwards made another which showed the same thing.

* By 'slide plate' we mean a cylindrical metal plate of even diameter, about three inches in length, which is inserted in the head of the cane, and which encloses the lock when it is shut up.

In these days, the liberal arts flourished, and learning met with proper encouragement; but afterwards they became neglected for a long time. Aristotle, who lived about two hundred and ninety years before Christ, was the first that writ any methodical discourse on mechanics. But, at this time, the art was contained in a very little compass, there being scarce anything more known about it than the six mechanical powers. In this state it continued till the sixteenth century, and then clock work was invented, and about 1650, were the first clocks made. At this time, several of the most eminent mathematicians began to consider mechanics; and by their study and industry have prodigiously enlarged its bounds, and made a most comprehensive science. It extends through heaven and earth; the whole universe, and every part of it, is its subject. Not one particle of matter but what comes under its laws. For what else is there in the visible world, but matter and motion? and the properties and affections of both these are the subject of mechanics.—*Emerson.*

## TRUST TO YOURSELF.

'Trust to yourself'—is a glorious principle for the industrious and trading classes of the community; and yet the philosophy of it is not perhaps understood so well as it ought to be.

There is hardly anything more common in the country than to hear men spoken of who originally, or at some period of their lives, were rich, but were ruined by '*security*'—that is, by becoming bound to too great an extent for the engagements of their neighbors. This must arise in a great measure from an imperfect understanding of the question; and it therefore seems necessary that something should be said in explanation of it.

I would be far from desiring to see men shut up their hearts against each other, and each stand, in the panoply of his own resolutions, determined against every friendly appeal whatsoever. It is possible, however, to be not altogether a churl, and yet to take care lest we be tempted into an exertion of benevolence dangerous to ourselves, while it is of little advantage to our friends.

Notwithstanding the many ties which connect a man with society, he nevertheless bears largely imprinted on his forehead the original doom, that he must chiefly be dependent on his own labor for subsistence. It is found by all men of experience, that, in so far as one trusts to his own exertions solely, he will be apt to flourish; and, in so far as he leans, and depends on others, he will be the reverse. Nothing can give so good a *general* assurance of well doing as the personal activity of the individual, day by day, exerted for his own interest. If a man, on the contrary, suddenly finds, in the midst of such a career, a prospect of some

patronage which seems likely to enrich him at once, or if he falls into the heritage of some antiquated claims to property or title, that he thinks it necessary to prosecute, it is ten to one that he declines from that moment, and is finally ruined. The only true way to make a happy progress through this world is to go on in a dogged, persevering pursuit of one good object, neither turning to the right nor to the left, making our business as much as possible our pleasure, and not permitting ourselves to awake from our *dream of activity*—not permitting ourselves to *think that we have been active*—till we suddenly find ourselves at the goal of our wishes, with fortune almost unconsciously within our grasp.

*Chambers.*

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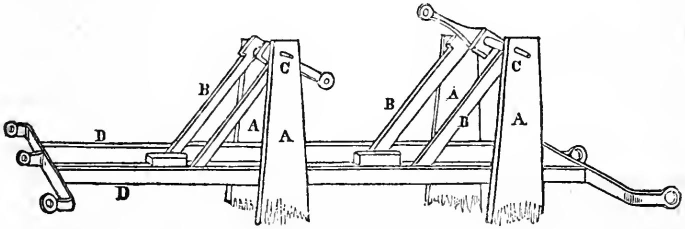
From the Journal of the Franklin Institute.

## HUSE'S MODE OF WORKING THE LEVERS OF FIRE ENGINES.

To all whom it may concern, be it known, that I, Samuel Huse, of Newburyport, in the county of Essex, and state of Massachusetts, have invented an improved method of working the levers of fire engines, and of other similar machinery, and that the following is a full and exact description of the same, reference being had to the accompanying drawing, which makes a part of this specification.




AAAA are standards which serve to support the fulcrums of the levers BBBB, as seen at CC. The lower ends of these levers working on joints in the traversing bars DD.

The uses of the other parts represented in the drawing will be evident upon inspection, and as they make no part of my invention, but are common to many fire engines, they do not require to be described.

The object is to work engines of this discription by traversing motion, the handles being attached to the traversing bars DD, which constantly preserve their horizontal position, and rise and fall no more than is due to the segment of the curve formed by the lower ends of the levers BB.

When an engine is worked in this way, it is necessary to scotch

the wheels, or in some other way to prevent a backward and forward motion in the body of the engine. This may be effected in various ways, or if preferred, there may be sliding bolts, or screws, made in the manner of legs, which may descend from the body of the engine, and support it whilst in action, independently of the wheels. I sometimes make the levers work across the engine, and in this case the wheels require but little checking.

I do not intend to confine myself, in carrying my said plan into operation, to the exact mode which I have here represented ; but what I claim as my invention is the constructing the working levers of fire engines, and of similar machinery, by attaching the handles thereto, so that the levers shall work backwards and forwards in the manner of a pendulum, upon the principle herein fully set forth. SAMUEL HUSE.

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## GAS MANUFACTORY.

THE Gas Manufactory, at the north part of Boston, has excited some attention, from the extensive use of gas in almost every part of the city. The following account from the correspondent of the Portland Advertiser, may be acceptable to our readers :

'The Gas House is an extensive brick building, at the north part of the city, marked by its lofty chimney and the dense smoke continually rolling from it. The process of making the gas is simple, although the machinery for its manufacture is quite complicated, and must have cost an immense sum. In one part of the building are furnaces, emitting an intense heat. Over these furnaces are boilers or ovens, containing the coal from which the gas is made. The smoke, gas, and tar rise together for some distance, when the tar separates from the smoke and is conveyed into cisterns, from which it is drawn out and sold. The smoke then continues on, I believe, to a large tub, in which it is separated from the gas, while the latter is conducted through a number of feet of pipe, similar in shape to a distiller's worm, under ground, for the purpose of condensing. It then enters the gas house again, passes through the refiner into a metre, and from the metre into a grand receiver, where it is ready for use. The metre is filled with water, and has a dial upon it which gives the accurate quantity of gas manufactured. There are two receivers, the size of which are 20 by 40 feet. Each receiver is divided into two parts. They shut into the bottom. The top part contains the gas, and bottom part water. The gas is conducted by a pipe through the water into the top part, which, as the gas fills it, rises from out the water, being balanced by an immense weight. When the receiver is full, the top is raised ; but as the gas is used from it, it gradually sinks into the lower part, and its weight is of sufficient force to press the gas to any part of the city. The gas

manufactured here, is a compound of coal and rosin gas. The rosin gas is of service in neutralizing the bad smell of the coal gas. The rosin also produces oil, which is used for fuel. The coal used is Newcastle coal. It costs $9 per chaldron; and after the gas is extracted, it is worth $7.

The tar made from the coal brings $7 per. barrel, and eight bushels of coal make a barrel of tar, besides the gas! If this is not a self-creating fund, I know not what is. The price of the gas is half a cent per foot. The lower part of each receiver contains 1500 hhds. of water. The receivers are of cast iron. The gas is conveyed under ground through leaden pipes, to the different parts of the city.'

The receivers mentioned above, are commonly called gasometers, and are in the form of a cylinder and open at the bottom. We presume they are 40 feet diameter, and 20 feet high, and are made of sheet iron; and instead of leaden pipes under ground they are of cast iron. EDS. Y. M.

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Translated for the Journal of the Franklin Institute.

## POLYTECHNIC SOCIETY OF PARIS.

THE editor has received from M. De Moleon, of Paris, the subjoined prospectus of the intentions of this Society, and it will afford him sincere pleasure to be made the medium of communication between this institution and any of his fellow citizens. His public situation in the department of State affords him facilities for transmitting to Paris papers or other articles, if delivered to him, free of expense, in the city of Washington, or left in the charge of the Actuary of the Franklin Institute in Philadelphia.

Not many years have elapsed since our country was dependent upon Europe for almost everything which was new either in science or the arts, but in this particular a rapid revolution has been effected, and we have now much of our own to offer in exchange for the information which we derive from the old world; and the principle both of national and individual honor urges us to be on the alert in cementing those ties by which the friends of literature and science all over the world are united, and form one great republic, whose united aim is the attainment of the highest intellectual, moral, and physical good.

'POLYTECHNIC SOCIETY.—This society has been established by the former pupils of the polytechnic school, all of whom are conversant with the useful arts, and with commerce.

The object of the society is to promote the progress of the useful arts, and to supply the wants of the manufacturing, commercial, and agricultural classes, more especially in France. Its principal means are—

1. An extensive correspondence with its members at home and abroad.

2. A capability, in consequence of an understanding with the heads of establishments, of seeing all orders faithfully executed.

3. A large collection of very perfect models of machines to serve as specimens, and to be exhibited at a particular place.

4. The *Receuil Industriel, &c.* of M. De Moleon; a valuable and interesting journal, which is the vehicle of all the observations and discoveries of the society, and of the results of the communications of its members in every part of the world.

In its organization are included—

1. The class of manufacturers, who attend to the interests of manufacturers, machinists, &c.

2. The class of manufacturers, who watch over rural economy.

3. The class of commercialists, whose vigilance is directed to commerce and its various dependent interests.

Foreign ambassadors are invited to supply the wants of their respective countries through the agency of this society; they will address "*Au directeur de la Societe Polytechnique, Rue neuve-des-Capucines, No. 13 bis.*" '

M. De Moleon, in a letter to the Editor, says that, 'The design of this society is to supply the wants of the productive classes in all countries; to obtain for the use of manufacturers, mechanics, agriculturalists, and artists, the machines which may be useful to them, either in the form of models, or of operating instruments; to attend to their completion, and the transmission of them wherever they may be required; to furnish to those engaged in commerce such documents, and other aids as may contribute to its prosperity.'

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## QUESTION.

After mowing a strip 2 rods in width around a lot in the form of a right angled triangle, containing 3 acres, I found I had cut one half the grass. Required the length of the base and perpendicular? C. M.

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### TO CORRESPONDENTS.

A communication from W. W. C. is received, and under consideration.

# THE

# YOUNG MECHANIC.

## DECEMBER, 1833.

### CHEMISTRY.

#### PROTOXIDE OF NITROGEN.

*Nitrous Oxide—Gaseous Oxide of Azote—Exhilarating Gas—Dephlogisticated Nitrous air.*

Protoxide of nitrogen is a colorless, elastic gas, possessing a slight odor and a sweet taste. It may be condensed to a liquid, as has been shown by Mr. Farraday, Phil. Trans. 1823. Its specific gravity air being 1, is 1·527.—100 cubic inches, weigh 46·57 grains.

It is a supporter of combustion ; most substances burn in it with more energy than in the atmosphere. Water, freed from air, absorbs about 9-10ths its bulk of this gas at 60° F., and acquires a sweetish taste. It is absorbed also by ether, alcohol, and essential oils, in larger proportion than by water, and may be separated from them unchanged.

It was discovered by Dr. Priestly in 1772, and called by him dephlogisticated nitrous air. Its properties were elucidated by Sir Humphrey Davy, in 1799, and it received from him the name of nitrous oxide.

*Composition.*

| | | |
|---|---|---|
| By volume, | 100 Nitrogen, | 50 Oxygen, |
| By weight, | 14 Nitrogen, | 8 Oxygen, |

Its atomic weight, $14 + 8 = 22$.

*Preparation.*

Protoxide of nitrogen cannot be formed by the direct union of its elements ; but it may be obtained by a variety of processes in

which nitric oxide or nitric acid are decomposed by substances capable of abstracting a part of their oxygen. The most convenient and economical process is, by the decomposition of nitrate of ammonia by heat.

1. Introduce into a glass retort enough of the salt to fill about one third its bulk, and apply to it a heat of about 450° F. by means of an Argand lamp or portable furnace. When the nitrate of ammonia becomes liquid, bubbles of gas are given off, which may be collected over water, which will absorb the nitric oxide, should any of this gas be formed. Care must be taken that the temperature of the retort be not too great. This may be easily known by the gas which is generated becoming more transparent, and of a redish color, owing to the formation of nitric oxide. When heated to 7 or 800° F. a luminous appearance is presented, followed by an explosion.

Theory of the process.—Nitrate of ammonia is composed of nitrogen, oxygen and hydrogen. During this process *all* the nitrogen, unites with a *part* of the oxygen, forming protoxide of nitrogen, and the remaining oxygen unites with the hydrogen, forming water. This will be rendered more clear by the following diagram, where the atomic proportions and weights are attached.

| | | | |
|---|---|---|---|
| | | Nitrogen, 1 prop. = 14 | = 54 |
| Nitrate of | Nitric Acid, 1 prop. = 54 oz. | Oxygen, 5 prop. = 40 | |
| Ammonia 71 oz. | Ammonia, 1 prop. = 17 oz. | Nitrogen, 1 prop. = 14 | = 17 |
| | 71 | Hydrogen, 3 prop. = 3 | 71 |

Now the two proportions of nitrogen $(14 + 14 = 28)$ uniting with 2 proportions of oxygen $(8 + 8 = 16)$ form protoxide of nitrogen $= 44$.

The remaining 3 proportions of nitrogen $(8 + 8 + 8 = 24)$ uniting with the three proportions of hydrogen $(1 + 1 + 1 = 3)$ form water $= 27$, and $44 + 27 = 71$, the weight of the nitrate of ammonia.

2. Nitrous oxide may also be formed by exposing nitric oxide gas to the action of iron filings, or other substances, which have a strong affinity for oxygen. Sulphate of potass, muriate of tin, dry alkaline sulphurets and zinc effect this change.

3. When dry nitric oxide and dry sulphuretted hydrogen gasses are mixed together over mercury, a mutual decomposition slowly takes place, nitrous oxide and water are formed, and sulphur is deposited.

4. Nitrous oxide is produced during the solution of several of the metals in nitric acid. The gas in these cases is always mixed with nitric oxide, and often with nitrogen.

5. By heating a saturated solution of nitrate of iron, or distilling to dryness nitrate of zinc, protoxide of nitrogen is formed.

Protoxide of nitrogen may be decomposed by passing through it a succession of electric sparks ; or by passing it through a tube

heated to redness. It has been analysed by Sir Humphrey Davy by means of hydrogen gas. A mixture of these two gasses being inflamed by an electric spark is converted into water and nitrogen, and hence, its composition may be easily determined.

The action of protoxide of nitrogen upon the animal system for several years after its discovery was unknown, and it was supposed to be irrespirable until the experiments of Sir Humphrey Davy proved its remarkable properties when respired. Warm blooded animals soon die when confined in it. When taken into the lungs it produces different effects upon different individuals, but generally a great excitement occasioning a rapid flow of vivid ideas,—a feeling of lightness, a propensity to laugh and to indulge in violent muscular action accompanied with a feeling of indifference or recklessness of consequences, a forgetfulness of the past and without thought of the future. The whole of the mind's attention becomes absorbed in itself, and it loses all recollection of every thing around. I cannot better describe the influence which this gas produces, from personal experience, than by saying that I enter upon a new existence, so totally different are my sensations from former ones ; an existence so pleasing that the past is forgotten, and as the influence of the gas gradually diminishes and I return to my former state, it appears as new to me, and my feeling of surprise is as great as though years had elapsed since I left it. What is particularly remarkable is, that after the influence of the gas is over, the individual does not feel the languor and depression of spirits which usually follows exhilaration from other causes; on the contrary he is usually rendered more cheerful for several hours after the violent effects of it have subsided, and in a few instances its influence has been felt for several days. These pleasing effects, however, are not always produced by nitrous oxide. Different individuals are differently affected. Persons of a plethoric habit, upon inhaling it, are affected by giddiness and languor, followed by headache and other disagreeable symptoms. Judgment therefore is required in administering it. Prof. Silliman states that of the multitude to whom he has administered it, about six out of eight have been agreeably affected. From the experience I have had, though limited, I am induced to doubt whether so large a proportion are unpleasantly affected. Of those to whom I have given it, or to whom I have seen it aministered, only two or three out of perhaps as many hundred, have spoken of their sensations as disagreeable. There is, however, a feeling of oppression at the lungs, not uncommon, when the gas is first inhaled, but this soon goes off, and I have never known it to prevent the individual from taking a second dose. Of the immense numbers who have inhaled it, it has, so far as my knowledge extends, never proved fatal in any instance, yet this is to be feared in the class of persons before mentioned.

The quantity usually respired is from four to six quarts, breathed from and into an oiled silk, or caoutchouc bag, or bladder, furnished with a stopcock and mouth piece with a bone of not less than one fourth of an inch diameter.

There is no satisfactory theory by which we can account for the action of protoxide of nitrogen upon the animal system. It cannot but be regretted, says Prof. Silliman, that so powerful a stimulus, both for our physical and intellectual powers, should remain a subject of mere curiosity or merriment. Differing from every other stimulus, in not producing depression correspondent to the excitement, why should it not be employed as a general tonic, and as a comforting reviving remedy ? We shall conclude this article by giving an account of the effects of this gas upon a few individuals. Sir Humphrey Davy thus describes the effect it had upon himself :

'Having previously closed my nostrils, and exhausted my lungs, I breathed four quarts of nitrous oxide, from and into a silk bag. The first feelings were similar to those produced in the last experiment, (giddiness,) but in less than half a minute, the respiration being continued, they diminished gradually and were succeeded by a sensation analogous to gentle pressure on all the muscles, attended by a highly pleasurable thrilling, particularly in the chest and the extremities. The objects around me became dazzling, and my hearing more acute. Towards the last inspiration the thrilling increased, the sense of muscular power became greater, and at last an irresistible propensity to action was indulged in. I recollect but indistinctly what followed : I know that my motions were various and violent.' *

'Mr. Wedgwood breathed atmospheric air first, without knowing it was so. He declared it to have no effect, which confirmed him in his disbelief of the power of the gas. After breathing this sometime, however, he threw the bag from him, kept breathing on laboriously with an open mouth, holding his nose with his left hand, without power to take it away, though aware of the ludicrousness of his situation ; all his muscles seemed to be thrown into vibrating motions ; he had a violent inclination to make antic gestures, seemed lighter than the atmosphere, and as if about to mount. Before the experiment he was a good deal fatigued after a long ride, of which he permanently lost all sense.' *

The following case should serve to produce caution on the part of those who administer nitrous oxide. A student of Yale College, about nineteen years of age, of a sanguine temperament, and possessed of the most perfect health, breathed the gas, which was prepared and administered in the usual manner. Immediately his feelings were uncommonly elevated, so that (as he expresses it) 'he found it impossible to refrain from dancing and shouting.' Indeed, to such a degree was he excited, that he was thrown into

* Davy's Researches.

a frightful delirium, and his exertions became so violent, that after a while he sunk to the earth exhausted, and there remained until having by quiet in some degree recovered his strength, he again rose, only to renew the most convulsive muscular efforts and the most piercing screams and cries ; within a few moments, overpowered by the intensity of the paroxysm, he again fell to the ground apparently senseless, and panting vehemently. For the space of two hours these symptoms continued ; he was perfectly unconscious of what he was doing, and was in every respect like a maniac ; he states, however, that his feelings vibrated between perfect happiness, and the most consummate misery. The effects remained in a degree for three or four days.

The effect which this gas had upon another member of the same college, a man of mature age and of a grave and respectable character, is described as follows : For nearly two years previous to his taking the gas his health had been very delicate, and his mind frequently gloomy and depressed. This was peculiarly the case, for a few days immediately preceding that time ; and his general state of health was such that he was obliged almost entirely to discontinue his studies, and was about to have recourse to medical assistance. In this state of bodily and mental debility he inspired about three quarts of nitrous oxide. The consequences were, an astonishing invigoration of his whole system, and the most exquisite perception of delight. These were manifested by an uncommon disposition for pleasantry and mirth, and by extraordinary muscular power. The effect of the gas was felt without diminution for at least *thirty hours*, and in a greater or less degree for more than a week.

But the most remarkable effect was that upon the organs of taste. Antecedently to taking the gas he exhibited no peculiar choice in the articles of food, but immediately subsequent to that event, he manifested a taste for such things only as were sweet, and for several days ate nothing but sweet cake. Indeed, this singular taste was carried to such excess, that he used sugar and molasses not only upon his bread and butter and lighter food, but upon his meat and vegetables. This he continues to do even at the present time, and although nearly eight weeks have elapsed since he inspired the gas, he is still found pouring molasses over beef, pork, poultry, potatoes, cabbage, or whatever animal or vegetable food is placed before him.

His health and spirits since that time have been uniformly good, and he attributes the restoration of his strength and mental energy to the influence of the nitrous oxide. He is entirely regular in his mind, and now experiences no uncommon exhilaration, but is habitually cheerful, while before, he was as habitually grave, and even to a degree gloomy.*

* Amer. Jour. Vol. 5.

## BOOK-KEEPING.

It is said that when the Indian chief Black-hawk was introduced into the bank, he could not be made to comprehend the duties of the clerks with their pens. Doubtless, with his rude notions, he would have chosen some other method of keeping accounts than that adopted by the silent and busy accountants in the white man's great house for money.

The art of book-keeping is altogether useless to the savage, and unfortunately many of those who claim to be civilized, and to engage in affairs of business, value the art of keeping accounts by a systematic method almost as little as the untutored sons of the forest.

The principles of the art, as applied to the relations of debtor and creditor, between man and man, are so very simple that many suppose the art may be practised by a person of ordinary abilities without study. The consequence is, that all the advantages which might be derived from a knowledge of a perfect system are lost. It is true there is a cause for this besides the apathy of many respecting improvements of great importance. The text books relating to the subject have been adapted to the business of the wholesale merchant, and the necessary modifications to suit them to other business have not been given.

Men of learning, in whose hands the direction of education among the mass of community is placed, have not been aware of the utility of a knowledge of the principles of this useful art, and being themselves ignorant of it, have not recommended it.

Perhaps we should not exceed the bounds of probability, if we should conjecture that not one in five hundred of the young gentleman who graduate from our colleges are capable of taking charge of the accounts of any large establishment. It follows, as a matter of course, that when they are called to take the oversight of our academies and high schools, this branch of education is either entirely neglected, or taught in such a manner that no advantage is derived from it.

Persons who engage in mercantile affairs generally pay some attention to the art after they commence business, and by adopting the methods which they find to be customary with others in similar business, they are generally able to keep a tolerably correct account of their debts and credits. This may be done by a method called *single entry*, to distinguish it from the perfect system which is denominated the method by *double entry*.

But this method does not show the situation of the affairs of the owner of the property any farther than they depend on debts and credits. He therefore loses all the advantage to be derived from an accurate knowledge of his own resources, and the sources of his gains, or the cause of his losses. The want of perfection in

the method he pursues exposes him likewise to important errors, which are not always detected. It would indeed be a very great improvement in the mode of conducting business common with many *mechanics*, were they as careful of their accounts as even the more negligent of the merchants. But it often happens that at the commencement of business the mechanic, either from the circumstance of dealing for ready pay, or from the limited nature of his business, progresses for some time without perceiving the necessity of a careful attention to his accounts.

When his business becomes more extended, his attention and his time are too much occupied to allow him to learn a system, and a habit of trusting to his memory has already introduced some errors into his books. Still the habit is continued. Charges are sometimes neglected, credits are seldom given, settelments are made by *jumping*, his books are months behind in posting, the magnitude of the task of bringing them up prevents him from undertaking it while business presses, and thus he goes on from year to year. Suddenly, perhaps, he is taken away by death, his estate is represented insolvent, and, from the impossiblity of obtaining just settlements, is found to be so in fact. His family are left destitute. Those who have observed the customs of mechanics in regard to their accounts, and especially those who have been conversant with the settlement of their estates, can attest to the frequency of cases like these, except that the inadequacy sometimes overtakes them before death, and they are driven to the necessity of beginning the world again under many embarrassments and discouragements.

How frequently failures in business among the merchants arise from negligence in keeping or inspecting accounts, it is not so much our present object to inquire. That they might sometimes be avoided by attention to the subject, there can be no doubt.

Were the community aware of the importance of more attention to this subject, in the education of the young, the remedy would be easy. Instructers of youth would be required to qualify themselves for teaching the science, and every young man would be instructed to consider himself unprepared for active life till he should have made himself a master of the art. Till this shall be done, the workingmen will never take their proper rank in the community.

This subject may be resumed again, if an interest should be manifested in it, and a sketch of the history, and an outline of the principles of the art may be given. G.

## PATENTS FOR MASSACHUSETTS.

*Granted in March,* 1833.

From the Journal of the Franklin Institute.

For an improvement in the mode of *Guiding all Endless Bands, Belts*, or *Aprons* while in motion; Samuel Sawyer, Boston, Massachusetts, March 30.

This is a simple, and, we have no doubt, an effective instrument. The endless band, or apron, passes over a roller, fixed in a suitable frame, and turning upon gudgeons. The frame has a centre pin on its lower side, which passes down into a hole, that allows the frame with its roller to swivel round. A shank, or rod, extends out at right angles from the frame of the roller, and at a suitable distance it is crossed by another piece forming two arms, parallel to, and of about the same length with, the roller. Each of these arms is bent over at the end, to receive and embrace the edges of the band, or apron. Should the band, in motion, now deviate either to one side or the other, its edge will press against the turned over end of one of the arms, which will immediately cant the roller, and right the band.

The whole is clearly explained, and distinctly represented in the drawing, but the specification refers to the model, which it claims as making a part of the patent.

For an improvement in the mode of *Cleaning and Ginning Cotton Wool*, and freeing it from the seeds, &c.; Samuel Sawyer, Boston, Massachusetts, March 30.

Between the two rollers, fixed in the manner of the ordinary roller gin, there is a third smaller roller, with its centres forward of them, and occupying nearly the whole of the gripe between them. Around this smaller roller passes an endless apron, and as the cotton is fed to, and drawn in forcibly between the gin rollers, the minuteness of the spaces causes all seeds and other hard substances to be completely squeezed out, whilst the cotton is carried in upon the endless apron, and is taken off by a revolving belt cleaner. The guide roller, described in the specification last referred to, is applied to the endless apron in this machine.

For an improvement in his method of *Cleaning and Ginning Cotton Wool;* Samuel Sawyer, Boston, Massachusetts, March 30.

This improvement consists in applying a plate, or blade, of metal or wood, in contact, or nearly so, with the small roller carrying the apron, as described in the last specification. The cotton being fed between the blade and the roller, is drawn in, and the seeds, &c. completely excluded. This blade, which is called a preventer, it is observed, may be advantageously applied to the common roller gin.

There is a strong resemblance in the principle of operation, though but little in the mode of fixture, between this blade and the guard mentioned as applied to the roller gin of the Messrs. Whittemore.

For a mode of *Combining Rollers, with a connecting Belt, or Apron, whereby Fleece, or Skin Wool, may be held or strained over a surface, so that foreign substances may be removed;* Samuel Sawyer, Boston, Massachusetts, March 30.

An endless apron is held up against a fluted roller, by two small rollers, over which it passes. The fluted roller allows burs, or other foreign substances, to pass between it and the apron without being crushed, and as the fleece passes over the smaller rollers, everything of the kind is exhibited to view, and readily brushed or knocked off. We should make our description much too prolix, were we to attempt a verbal explanation of the whole arrangement of this machinery. The guide roller is applied to the endless apron of the machine.

For machinery for *Cleaning Animal Wool &c.;* Samuel Couillon, Jr., Boston, Massachusetts, March 30.

The specification of this patent extends over eleven closely written pages, which might, however, be reduced to two, if the repetitions and other redundances were pruned away. We shall not attempt an analysis of the specification, and even the claim itself we shall condense very much. The former informs us that the object of the invention is the cleaning of animal wool from foreign substances, in the fleece, or otherwise; and that for this purpose the fibres of said wool are to be straightened in such a manner as to bring the burs or other foreign materials on the surface, when they are to be removed 'by scraping, cutting, pinching, blowing, or striking them off, as hereinbefore specified.'

A further claim is to the mechanical arrangement of his machine, as described, with the exception of two small drawing rollers, invented by Samuel Sawyer, and used with his approbation.

The fleece is stretched by means of fluted or other rollers, over and between which it passes; from them it is drawn against a straight metallic edge, in passing which, the fleece is beaten by a revolving beater having projections on it, which serve to disentangle the fibres, to straighten them, and remove the foreign substances.

There appears to be considerable resemblance between this machine and that last described, not only as regards the object in view, but also in the mode of accomplishing it.

## ANSWER.

Messrs Editors.—I believe there are several questions in the Young Mechanic that have not been answered; and as it would be well to have the answers as far as practicable in the same volume, I send you an answer to the question in the August number, namely, How the pressure of water against the turning gates of the Charlestown Dry Dock is calculated; whether we measure back from the gates one, two, three, four or five feet, or whether we take the whole extent of the ocean? It is also said that they sustain a pressure at high water of 800 tons.

In answering this question, there are two principles by which we must be governed. First, that the pressure of a liquid depends upon its height or depth, and also the extent of the surface exposed to its pressure; and secondly, that the pressure is exerted equally in all directions.

Upon inquiry I find that the height of the turning gates is 30 feet, and their breadth 32 feet each, making a surface of 1920 square feet, for the water to press against. I would remark here, that the full breadth of each gate is 33 feet; but owing to the construction of the hinges and junction of the gates, it was thought more correct to call it 32 feet, and although the gates are 30 feet high, the general height of the water is 27 feet, but it sometimes stands as high as 30 feet.

I shall make the calculation upon the supposition, that the depth of the water and height of the gates, are equal to 30 feet, and the breadth of the two gates 64 feet. Now, 64 multiplied by 30, gives 1920, the square feet of surface of the two gates; which must be multiplied by the average pressure on each square foot. It must be evident, that a square foot of surface at the lower part of the gates, sustains a greater pressure than the same extent of surface near the top. The fact is, that the average pressure, is equal to what the gates sustain at the centre, or half way up; that is, a pressure equal to that of a column of water 15 feet high.

A cubic foot of sea water weighs 64 pounds, and 15 times this or 960 pounds, is the weight of a column of water one foot square, and 15 feet high, which is the average pressure on every square foot; and 960 the pounds on each square foot, multiplied by 1920, the number of square feet, gives 1,843,200 pounds for the whole pressure; which being divided by 2,000, the pounds in a ton, gives 921 tons and 6 tenths, as the pressure sustained by said gates. The horizontal extent of the water back from the gates, must not be taken into the calculation.

PHILO.

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